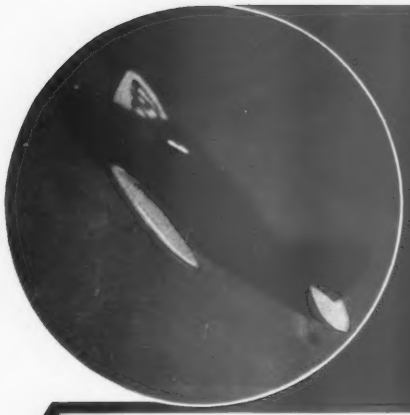
FLYING AND POPULAR AVIATION

AUGUST 25c
In Canada 30c

HE LUFTWAFFE WILL LOSE

By Archduke FRANZ JOSEPH



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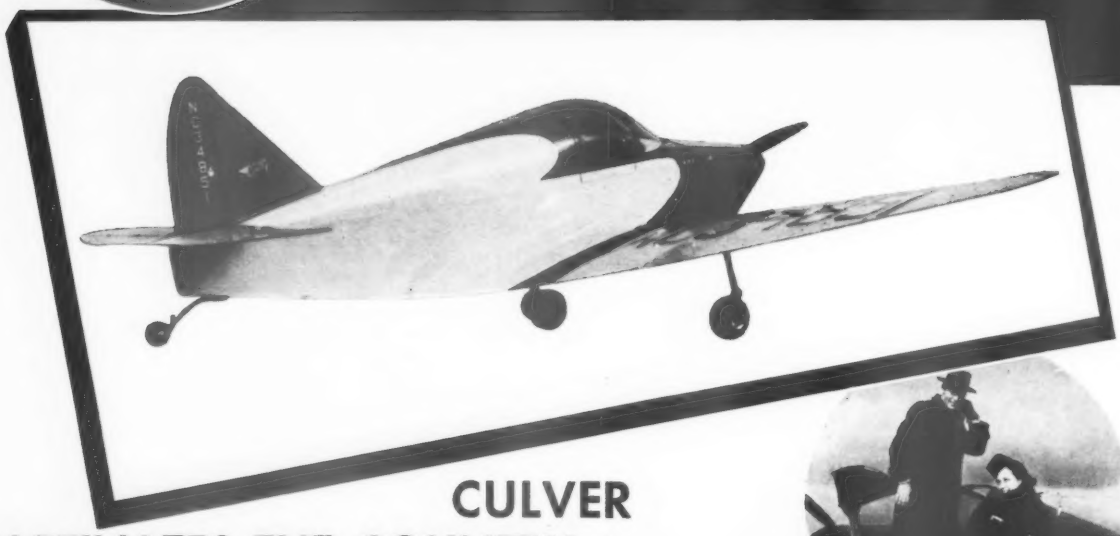

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and in such jobs as these that lead to executive positions.

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Trains You for Leadership in Commercial Aviation *From the Ground Up!*

Have you charted your course for your future in commercial aviation?

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The commercial aviation industry is interested in flying and mechanical skills, of course — but of greater importance is a solid foundation of fundamental principles.

Advancement to leadership in the *business* of aviation requires thorough preparation training *from the ground up*, a knowledge of fundamentals that leads to success. That's why, today, there are Parks graduates in each of the important positions listed here. Their foundation training prepared them for leadership.

A glance at the chart shows you some of the many phases of commercial aviation. The opportunities are many — but *your* future success depends on the type and thoroughness of your training. That's why Parks courses provide you with a *college education* majoring in aviation — executive training including a broad educational background in addition to essential technical skills. Parks teaches you the *why* as well as the *how* — develops your ability for independent thinking in the solving of new problems.

To be eligible for admission to Parks Air College, you must be a graduate of an accredited four-year high school or equivalent preparatory school, with a ranking in the upper two-thirds of your class.

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East St. Louis, Illinois

PARKS AIR COLLEGE was founded August 1, 1927.

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Is accredited in its Aeronautical Engineering School by the Illinois Superintendent of Public Instruction.

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Has its own airport with a school plant of 25 buildings devoted to school purposes entirely, also two fields of 568 acres and 96 acres for military flight training.

Has a faculty of 82, each especially qualified for his particular field of instruction.

PARKS AIR COLLEGE Section PA-8
East St. Louis, Illinois

Please send me details of four major courses in commercial aviation training.

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City ..... State .....

DOWN at Birmingham the other day the Birmingham Aero Club adopted a resolution advocating an all-out unified air force. In effect, at least, the Birmingham group condemned our military aviation picture as it stands today. As we listened to the advocates of a separate air force drive home their points, one would think there is little hope for either our Army or Navy aviation in its present form.

We've been puzzled by many ramifications of the "separate air force" controversy. We're inclined to agree that the British and German air forces have proved the value of such organizations. But at Birmingham, for instance, no one apparently thought our present Army Air Corps worth discussing. They trumpeted for the all-out junking of our present air arms, saying we must have our military aviation entirely separate from the Army or Navy. We wanted to ask them what they found wrong with our present GHQ Air Force, our Deputy Chief of Staff for Air, our Assistant Secretary of War for Air? The Army Air Corps even has its own, separate promotion list that is not affected by conditions in the cavalry, infantry or artillery. If that doesn't come awfully close to actually being a separate air force, we've been considering a false picture for years.

If the good-intentioned Birmingham folk are vitally interested in this subject, then they have, at best, several months of concentrated research ahead of them before they can condemn our entire air force in a sweeping gesture. They, like all civilians, are just bystanders. The Army as well as the Navy is in a far better position to compare the relative merits of the British or German air force with those of our own. On the surface, it appears that Britain's and Germany's use of military aviation is best. But, like many other things with which we deal, appearances can sometimes be deceiving.

* * *

On May 21 a British representative invited us to fly coast-to-coast as part of the crew of a new bomber being delivered to them. On the night of May 27 we were aboard a four-engined Consolidated *Liberator* for the RAF, headed non-stop from San Diego to New York City. Captain of the flight was Dick McMakin, former United Air Lines and Dutch KLM pilot; with E. P. Lott, another UAL veteran as co-pilot. The rest of the crew consisted of a flight engineer, a radio operator, an "observer" (that's us) and a Coast Guard pilot's shepherd dog being shipped to New York.

Flying mostly at 11,000 feet, we made

(*Continued on page* 106)

FLYING
AND POPULAR AVIATION

Volume XXIX Number 2

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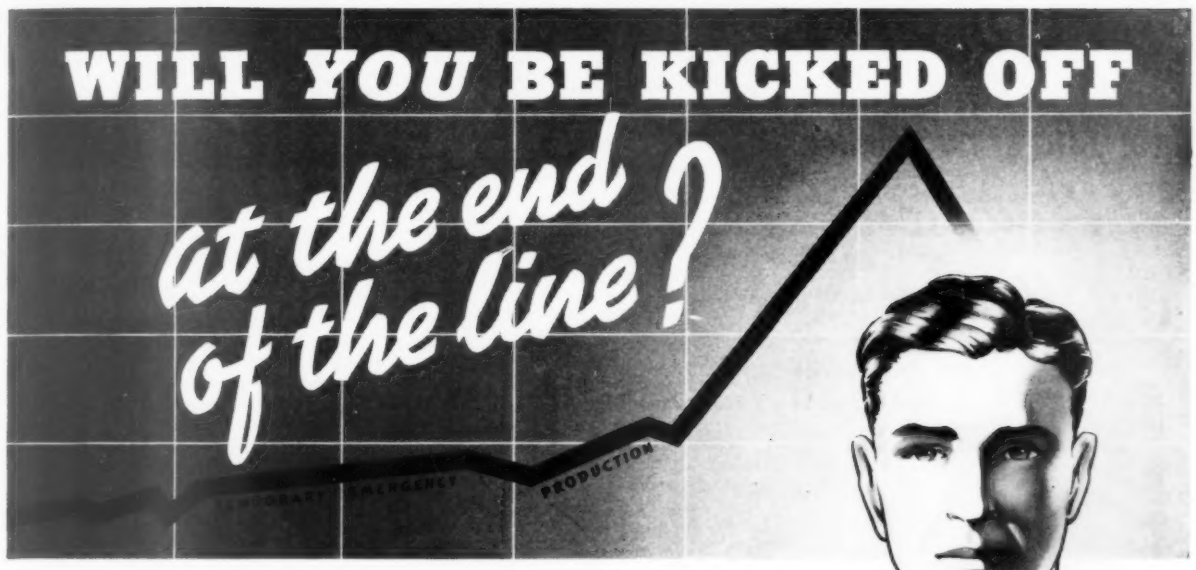
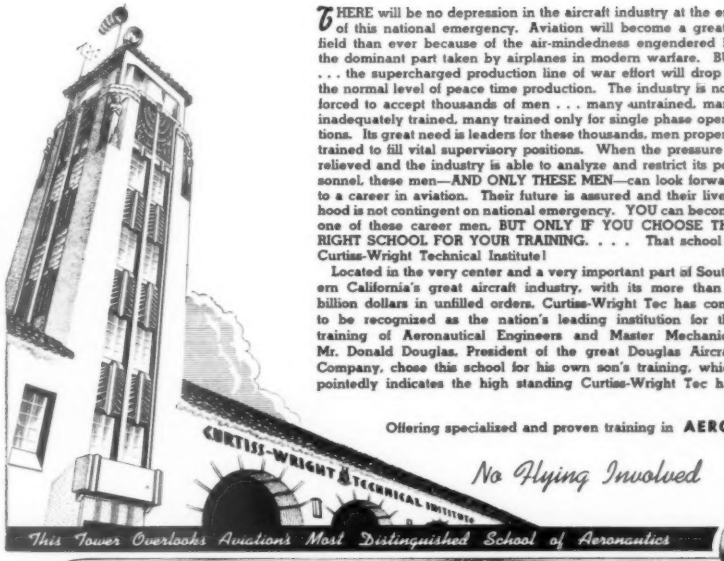
WILL YOU BE KICKED OFF at the end of the line?



AVIATION HAS JOBS FOR THOUSANDS
BUT CAREERS ONLY FOR TRAINED MEN



This Tower Overlooks Aviation's Most Distinguished School of Aeronautics

THERE will be no depression in the aircraft industry at the end of this national emergency. Aviation will become a greater field than ever because of the air-mindedness engendered by the dominant part taken by airplanes in modern warfare. BUT . . . the supercharged production line of war effort will drop to the normal level of peace time production. The industry is now forced to accept thousands of men . . . many untrained, many inadequately trained, many trained only for single phase operations. Its great need is leaders for these thousands, men properly trained to fill vital supervisory positions. When the pressure is relieved and the industry is able to analyze and restrict its personnel, these men—AND ONLY THESE MEN—can look forward to a career in aviation. Their future is assured and their livelihood is not contingent on national emergency. YOU can become one of these career men. BUT ONLY IF YOU CHOOSE THE RIGHT SCHOOL FOR YOUR TRAINING. . . . That school is Curtiss-Wright Technical Institute!

Located in the very center and a very important part of Southern California's great aircraft industry, with its more than a billion dollars in unfilled orders, Curtiss-Wright Tec has come to be recognized as the nation's leading institution for the training of Aeronautical Engineers and Master Mechanics. Mr. Donald Douglas, President of the great Douglas Aircraft Company, chose this school for his own son's training, which pointedly indicates the high standing Curtiss-Wright Tec has attained in the aircraft industry since its establishment in 1929.

It is imperative that before you invest in a course of career training you determine what the returns will be on your investment . . . for your choice of a school in which to take your training will determine how much money you will make all the rest of your life.

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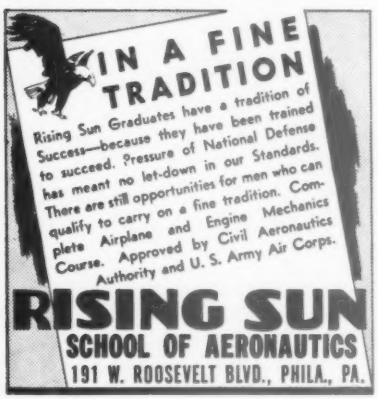
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Letters

Women Instructors

Sirs:

I heartily approve your campaign to promote use of civilian pilots and planes for national defense. . . . But won't you put in a word for the women? They are being discriminated against in the CPT program. They have been excluded from the secondary and instructors' courses and even washed out after having paid their fees and begun instruction. It seems only logical to me to train women as primary instructors in the civilian program. . . . Some women certainly could give primary instruction. This would release more men for more advanced work and for military service. It is not necessary that women be admitted to the secondary CPT program, which includes acrobatics. But, rather, there should be a separate, longer course leading to an instructor's rating, open to men and women not eligible for draft duty. . . .

MARGERY TAYLOR

Oxford, O.

● Women definitely have a place in aviation's national defense program, as evidenced by several primary flight instructors throughout the country who have proved themselves as capable as men. Sooner or later, the Army and Navy will have to recognize the possibility of using competent women flyers for certain phases of primary flight instruction.—Ed.

Tools and Books

Sirs:

. . . Today the most needed things are tools and books to help train men to use tools. I'm taking a national defense course in machine shop practice and am not the only one finding it difficult to get information as to where either of these can be bought (especially text books). I wish you'd give us some data on it. It's the only suggestion I can offer for improving your magazine. . . .

SAMUEL H. BORN

Philadelphia, Pa.

● Readers seeking lists of books on any subject in aviation may obtain that information by writing the Paul Kollsman library, Institute of the Aeronautical Sciences, Rockefeller Plaza, New York, N. Y. This library is one of the finest, most complete in the world.—Ed.

Credit Due

Sirs:

. . . Richard Martin's article in the June issue says, "Two light bombardment squadrons of B-18A's, the 34th and 36th, are stationed at Lowry Field." . . . Instead of the 34th, it was the Fighting 37th. The entire personnel deserves plenty of credit for their work in training bombardiers. . . . Martin's article was swell, but he should have said, "The 37th Scores Again."

P.F.C. BENJAMIN F. MAY,
37th Bombardment Sq. (M)

Chanute Field, Ill.

Aluminum

Sirs:

. . . At present there is no shortage of aluminum for national defense, although civilian applications have been materially curtailed . . . Just how long we will be able to say "there is no shortage of aluminum for national defense" is problematical . . . It depends largely on plane production, not only for the United States but for Britain as well. According to a recent announcement by W. S. Knudsen, the expanded plane program will require an annual production of 1,600,000,000 pounds of aluminum. The best available estimates indicate that this is more than the whole world produced last year.

Aluminum production in the U. S. during 1939 was 327,000,000 pounds. Domestic production at present is at the rate of nearly 600,000,000 pounds annually and, by July, 1942, will reach 825,000,000 pounds . . . The company will have expended $200,000,000, all of which it is financing itself for expansion.

DOUGLAS B. HOBBS,
Aluminum Company of America

Pittsburgh, Penn.

Messages

Sirs:

In the June issue of your excellent magazine, J. N. Becker states in "Traffic—Under Control" that pilots often call the tower thus: "Chicago tower from NC-23456." He says this form is incorrect and should be "NC-23456 to WGEH." . . . In the Pilot's Radio Manual or Civil Aeronautics Bulletin No. 29 (page 78) it states that standard message structure should be "Chicago tower from Stinson one, four, six, five, seven." As an aviation student taking advanced CPT training, my class and I naturally are interested in knowing just which is the accepted form all over the country.

JACK COUNTS

El Paso, Tex.

● The message structure in the CAA bulletin is recommended. However, airport control tower operators, like veteran Author Becker, are free to use whatever phraseology they deem satisfactory.—Ed.

How About Mechanics?

Sirs:

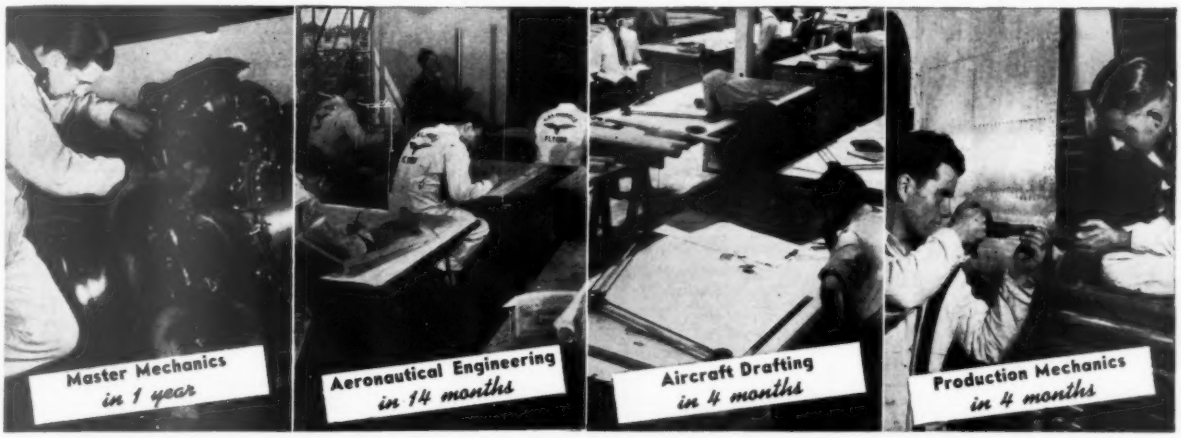
Have been an ardent reader of FLYING AND POPULAR AVIATION since 1935. In my collection I have several copies dated 1928 and 1929. I think you have a very fine magazine for the sportsman pilot and the aviation enthusiast. But how about the mechanic? After all, he is the one who makes the flying game safe. . . .

How about a page similar to your "I Learned About Flying from That," devoted to mechanics' experiences and called "How I Learned to be Careful," "Learning the Hard Way," or something similar? I believe that every mechanic has pulled a "boner." I know that I have

(*Continued on page* 103)

(in 4 to 14 months)

THIS TRAINING *places* YOU IN AVIATION



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"*I am a California Flyers Graduate.*" It means something to say that. It means that aviation wants you to the extent that over 96% of all California Flyers graduates are employed in the industry and that it is impossible to supply the demand for our graduates. It is a passport into aviation. Secondly, it means that you are a man marked to succeed like the California Flyers graduates before you. And that is what *really* counts.

Why does a California Flyers man stand so high? It is obvious once you have heard the complete story of this famous school. Its founders believe that aviation should be taught in a school where the student remained an individual—learning aviation as it pertains to his individual ambitions and qualifications, and by so doing preparing *him* for the responsibilities of leadership. This way the graduate is prepared to meet today's aviation problems and to contribute to tomorrow's aviation advancement. This is the way today's leaders learned. Only this way can a training program be built for the industry, on industry's specifications. They believe too, that the entire field of aeronautics:—engineering, mechanics and piloting are all closely interwoven and that a student should train in a school that teaches all of these important divisions. Above all, they believe that aviation should be taught in an environment of aviation activity, taught where the greatest aviation developments originate, taught where there is the greatest number of men actively engaged in aviation. This is why California Flyers is located in the heart of the world's aviation capital on the world's busiest testing field.

If this is the kind of school that you would like . . . friendly, efficient, modern and thorough; an aeronautical school operated by practical aviation men, you will be most interested in reading the *complete* story of California Flyers in the new 64 page catalog which tells today's story of aviation at work, complete details of the training courses and just what it takes to be a *California Flyers man.*

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Production Mechanics (Aircraft sheet metal) ☐ *Aircraft Drafting* ☐
Instrument and Radio Beam Flying ☐ *Master Mechanics* ☐
Instrument Technician ☐

Name_____ Age_____

Address_____

City_____ State_____

The Birdmen's Perch

Last month we announced a new policy—tougher problems. So we started off with a tough one and what happened? The customers not only get the wrong answers—they don't even get our explanation of the correct one! From now on, maybe we ought to call 'em *double-puzzles!*

Major Al Williams, alias "Tattered Wing Tips,"
Gulf Aviation Products Manager, Gulf Bldg., Pittsburgh, Pa.

FUNNYBONER DEPT.

Dear Major:

The other day I was sitting around the airport waiting for the wind to die down. As my thoughts wandered, I picked up a pencil and pad and set them down. Well, major, seeing it sort of fits in with your swell product, I decided to send it along and let you look it over.

Here it is:

I bought an airplane, second hand,
To some it's junk, to me it's grand.
Its motor used to spit and sputter
Till I met a man who began to stutter—
Use GGGGG-A-GGGGGGGGG!
I filled her tanks and off I went
And passed a Grummen h--- bent.
Well, mister, you can take it from me,
From now on I'll stick to G.A.G.!

Yours truly,

Wm. (Flying Bill) Ridley, Jr.

THIS MONTH'S BRAIN TWISTER

The following problem is undoubtedly one of the most difficult that has ever appeared on this page. You can blame your head-aches on Lt. Albert S. Ogden, of Upper Darby, Pa. If you get this one, boys and girls, you've *got* something!

A pilot takes off from his home airport and flies directly into the wind. Right after taking off, he sees his air-speed indicator is broken. So he decides to fly with a constant throttle setting and consequently a constant but unknown air-speed. Suddenly he finds himself flying into fog. Just as he enters the stuff, he notices a landmark directly under him which he knows to be 40 miles from his home field. He continues to fly (still into the wind, of course) into the fog on instruments for one-half hour. He then gives up and turning around instantly, heads for home. He flys out of the soup just in time to find himself *directly* over his home field.

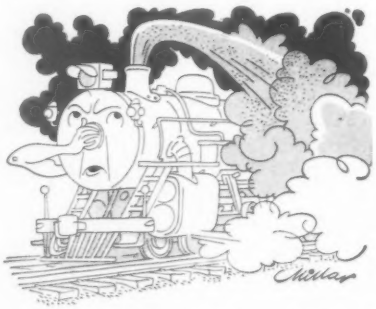
Assuming a constant wind velocity at all times, how fast is the wind blowing?

Lt. Ogden says par for the above is 20 minutes!—Ed.

ALL ABOARD FOR GULFPRIDE!

If you've ever watched a steam engine puffing down the tracks, you've noticed the thick black smoke that emerges from the stack when the fireman tosses on another shovelful of coal.

Why don't ordinary house chimneys smoke that way, too? It is because of the difference between hard coal and soft coal. Only soft coal is used in steam engines, and it is one of the characteristics of soft coal that it gives off plenty of soot and dirt. Hard coal doesn't.



It's the same with different kinds of crude oil. Some are naturally "cleaner." Others are like soft coal—and sometimes it is difficult to get them "clean" even with the best refining methods.

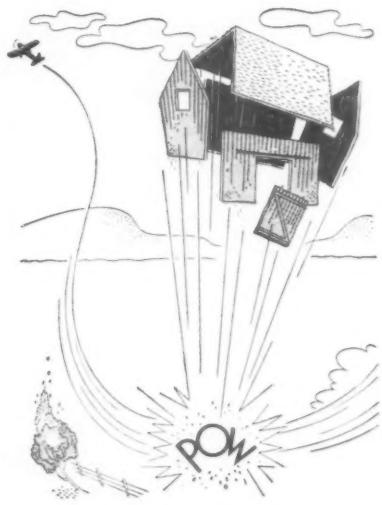
You'll be glad to know that we take no chances with Gulfpride. To make sure it will be the cleanest oil your engine could get, we start out *with only the finest crudes*. But then, we refine Gulfpride by means of our Alchlor Process—the special refining method that takes out more of the carbon-and-sludge makers.

This double-trouble we take with Gulfpride assures *you* the finest lubricant with which you could ever protect your airplane engine!

THIS MONTH'S WHOPPER

Dear Major:

A few years ago I had a job barnstorming in Pennsylvania. I had bought an old Jenny from the government scrap pile. My act was to fly through a small barn which had been built especially weak, for the occasion. But I had so little speed that sometimes the barn used to almost fall down on top of me.



One day, when I was ready to go up, I discovered that I was out of gas. There was a Gulf tank at the field, so I took on a gallon and just for a little extra filled a thermos jug I had along. I got in the Jenny, warmed up the motor and started down the field. About twenty feet before I got to the barn I opened up the throttle. Immediately I felt a blow on my face as I hit the barn. I went through it so fast that the barn didn't fall down till I was 10 miles away. About half an hour later I found myself over the ocean and out of gas.

I crawled out on the wing and poured in the G.A.G. from my thermos jug. When I finally was able to land I discovered that I was in a small town near Paris, France. So here I am—no G.A.G., no job, no barns, no nothing. All because I put my trust in a small amount of G.A.G. Major, it's *too* powerful!

Geary Eicher
Pitcairn, Pa.

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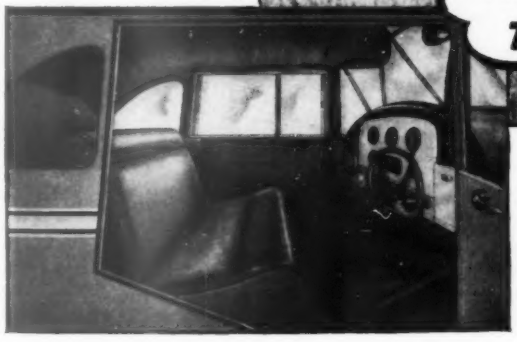

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P. A. AUGUST, 1941

Experimental

SOME 155 million years ago nature turned aviation designer and brought out a few experimental "ships" that would make even the wildest of freak designs look conservative by contrast. These forerunners of the birds, known as pterodactyls, had reasonably efficient wings; but, as we can see from their muscle arrangement, they were hopelessly underpowered. Their slow, reptilian muscles were not equal to the task of getting them off the ground readily, and it is more than likely they had to climb a tree or cliff in order to take off. So eventually Dame Nature charged them off as experimental and turned to higher-powered forms of aerial life.

For flight, whether animal or man-made, is basically linked to power. Through steady improvements in fuels and engines, aviation engineers have in a few short years paralleled nature's progress of the ages. And today the need for more and more power from each pound of engine, each gallon of fuel, becomes increasingly urgent.

It is to assist in the acceleration of this progress that the engineers of the Ethyl Gasoline Corporation work in close cooperation with aviation technologists. Already a program of continuous research has developed a great deal of useful data. Some of this information is immediately applicable. Much of it will be of greatest value in the days to come. All of it is dedicated to the proposition that the progressive evolution of American aviation shall never cease.

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Polly Smith Photo

CHARTING TOMORROW

Men who fly bombers across the ocean are doing more than making deliveries. They are blazing a new trail for merchantmen. Charting tomorrow. After the war, giant airships will follow the new trade routes charted by bombers. Rapid expansion of the air lanes will create a greater demand for skilled pilots, technicians, radio operators and mechanics. Men who learn aviation today are doing more than taking a course of study. They are investing in the future. Charting tomorrow.

PA-8-41

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German bombers maneuver en masse over Prague as victorious army parades.

Greatest weakness of the German Air Force is lack of replacement pilots and loss of individualism, says this royal Austrian refugee.

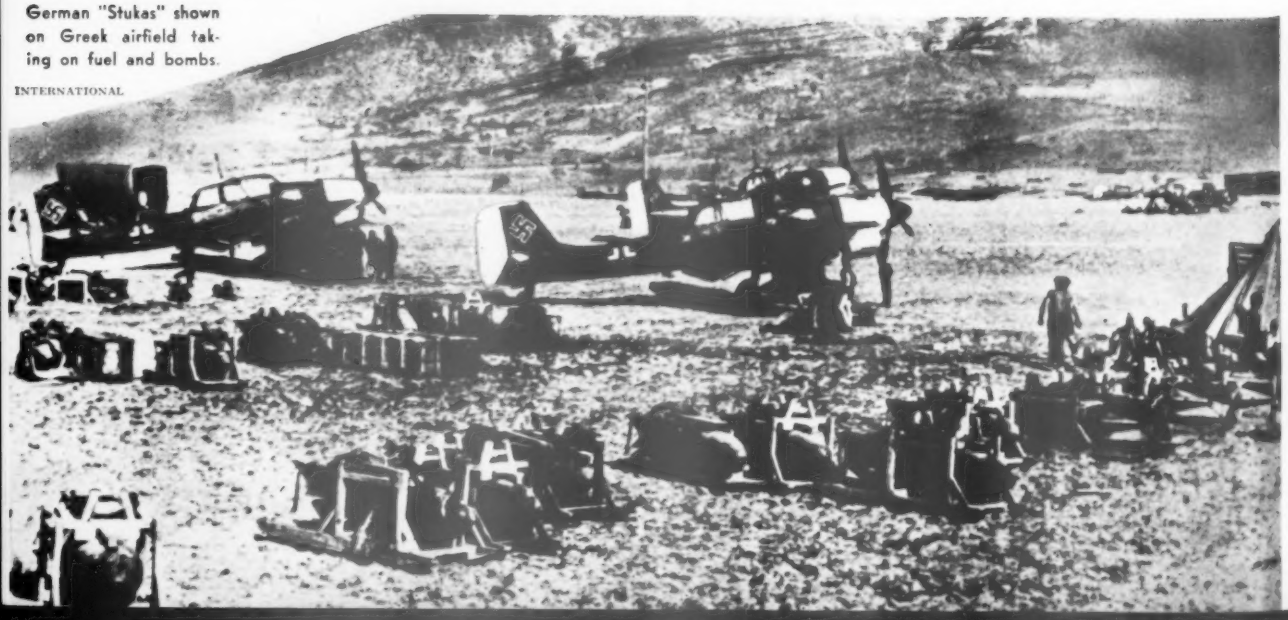
ACME

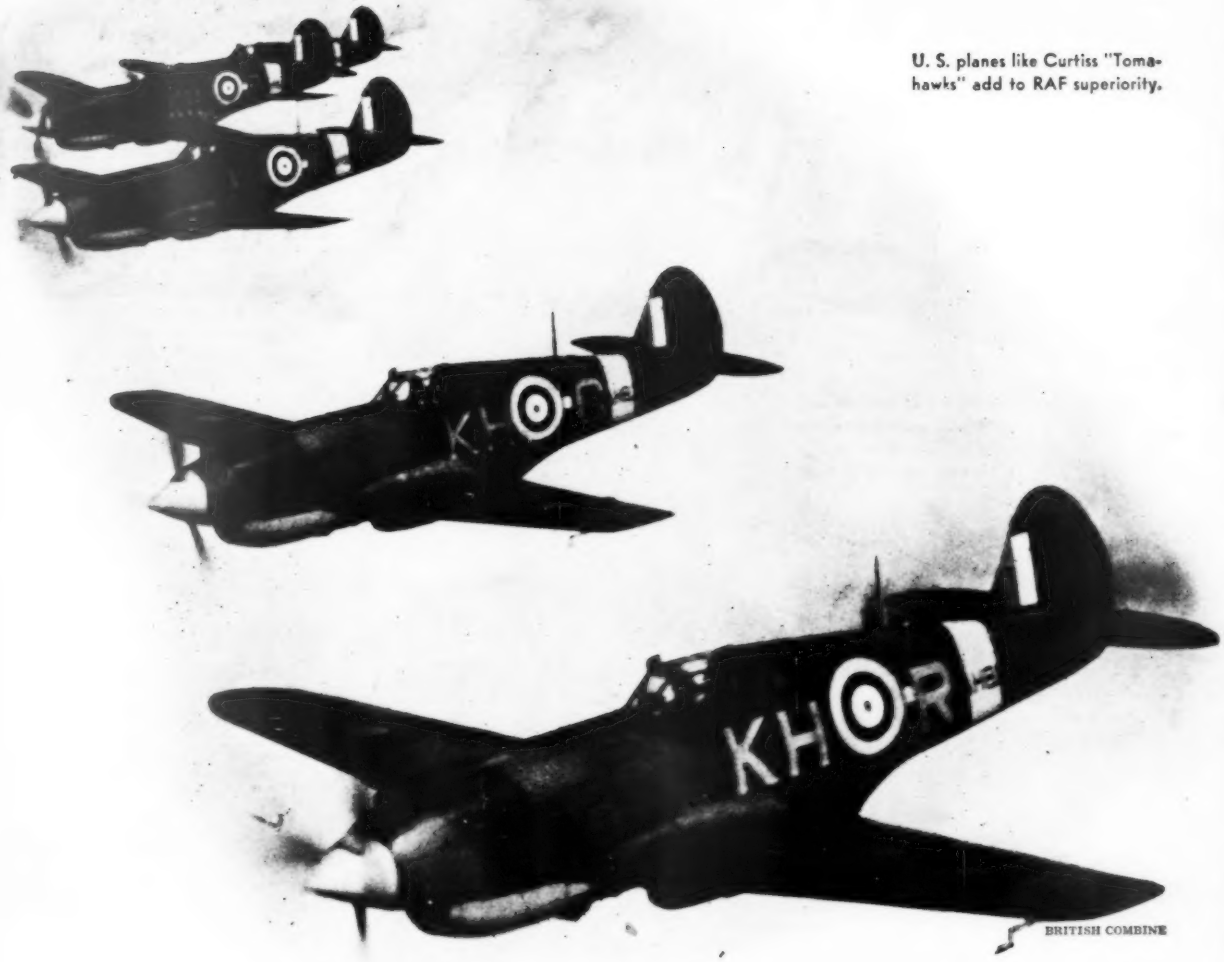
Archduke Franz Josef is himself a flyer with nearly 2,000 air hours to his credit. He was with Spain's Navy Air Arm as civilian observer.

WHY THE LUFTWAFFE

German "Stukas" shown on Greek airfield taking on fuel and bombs.

INTERNATIONAL





U. S. planes like Curtiss "Tomahawks" add to RAF superiority.

BRITISH COMBINE

WILL LOSE!

by ARCHDUKE FRANZ JOSEF OF AUSTRIA AS TOLD TO DONN HALE MUNSON

Archduke Franz Josef, a veteran sportsman pilot, has flown extensively in Europe and has owned several airplanes. Now in the U. S. as a refugee, he lives quietly in New York, still fears the Gestapo.—Ed.

THE German Luftwaffe will lose the war in the air to England's Royal Air Force. I feel as certain of that as I am that tomorrow will dawn. The failure of Hitler's air arm will be traced to one thing—*inferiority.*

Planes, pilots, ground crews and training—numerically strong as all those factors are—will not lead to a German victory in the air. From my observations in Germany and in England, there is a marked inferiority on the part of the Germans that all their blustering cannot cover. As an airman and an Austrian living many years of my life close to Germany, I have had many occasions to observe the workings of the German air arm. As a visitor to England, also, I have been permitted to see much.

While some air experts place the value of the English fighting machine as compared to the German craft at three and four to one, I am inclined to raise those figures and favor the English at six to one. I have read and heard stories of the supposed *ersatz* materials the Germans are said to be using but take no stock in them. I know, too well, that German ingenuity and determination would not permit the use of them. But there is a deeper inferiority. While it is true that the Messerschmitt Me-109 is a powerful and highly-maneuverable craft, my observation of it as compared to the British *Spitfire* leads me to believe that it is inferior in flying ability and construction.

I think I can detect defects in many of the German machines. The poor grade of aluminum used in Germany, the clever and intentional lack of endurance in the craft, the inability to take the pounding of high-speed fighting . . .

More important than the inferiority of the machines is the inferiority of the men who fly them. I am always more interested in the pilot than the plane because, no matter how good the machine, the man is the real threat. The Germans are a regimented race. They always fight in numbers; their precision depends on mass. Cut one German flyer off from his fellows and you have him.

Mass-minded, the German flyers I have seen falter when faced with an individual problem. It is then that the British strike. The German is a poor hand-to-hand fighter but the Englishman is superb. He is the rugged individualist al-

(*Continued on page* 84)

AIRLINE TEST PILOT

by MacDONALD H. HAYS

Robert Loomis is a test pilot, but not the Hollywood variety. His company relies on him for the safety of its big planes.

Ground crews inspect and load with gas and oil a Douglas DC-3 which Loomis is to take up for a test.

LIEUT. JOHN SMITH hears a whine, mounting to a shrill scream. The altimeter registers 18,000 feet, but is unwinding rapidly. The airspeed indicator—now at 400—quickly reads 450—then 500—m.p.h.

Smith sees a postage stamp field below suddenly grow to postcard size. With the r.p.m. needle full against the stop-peg, the plane is approaching terminal velocity. Back comes the stick. The airplane shudders, then goes into a steep climbing turn. A 9-G pull-out . . . that's a good ship, mister! . . .

This scene might describe any of a number of military aircraft test flights. But why all the speed? Why try to tear off the wings? What's back of a 9-G pull-out, a stall test, a spin characteristics check?

It's the safety angle. The safety angle applies, whether the airplane being tested is the newest Army pursuit model, or whether it's a Douglas DC-3 with a half-million dependable miles to its credit.

The military flyer wants a pursuit plane that will dive at 500 m.p.h. (if that is the placarded diving speed) with reasonable assurance that he won't be dodging stray bits of engine cowling and carburetor air scoop.

An airline pilot does not need a ship that will dive at 500 m.p.h. He wants a dependable airplane that will deliver passengers and cargo from coast to coast, day after day, in clear or instrument weather. And a very real and contributing factor to the success of these flights is that little known but hard working chap, the airline test pilot. His job is not to give the plane a terminal velocity dive test, but to go through a step by step routine procedure to make sure the airplane is 100 per cent okay before it goes out on a scheduled run.

Robert C. ("Bob") Loomis—with a background of four years at the University of California, four years as a Navy pilot and one year as fuel research engineer for the Standard Oil Company—is TWA's test pilot and research engineer at

the Kansas City base and a good example of airline flight test personnel. He's married and has a small son who began to follow in his dad's footsteps by taking his first air ride at the age of five months.

One day recently Bob invited me to accompany him on a test hop as his co-pilot, and I'd like to report what I saw and heard—first on the ground, then in the air.

It's early morning when Bob and I walk out into the hangar and up to DC-3 No. 357. Mechanics have just completed installation of new G-202A engines, which deliver 1,200 h.p. each at take-off instead of 1,100 h.p., as in the old G-102's. Since all G-102 engines in DC-3's of the TWA fleet are rapidly being replaced by the new and more powerful engine and each plane conversion is tested, Bob will have his hands full during the next few weeks.

We see an inspector whose only duty is to check the completed work of mechanics making his tour around the airplane. His duty is:

1. To inspect the operation of all controls and control surfaces.
   (a) Engine control cables.
   (b) Propeller pitch controls.
   (c) Radio.
   (d) Flap and aileron and elevator controls.
   (e) Hydraulic controls.
   (f) Heat (carburetor heat controls and heating system to passenger cabin).
2. Check gas and oil aboard.
   (a) Gasoline sumps clean.

Some 30 minutes later, after a thorough ground inspection has been made and mechanics using a small tractor have pulled No. 357 to its place on the ramp, Bob and I walk out and climb aboard. With us is Inspector Brown, whose job is to fill out the test flight report. In the cockpit I take out the check list, turn to the side "Before starting engines" and call out, "Amount of gasoline . . . 820 gallons, trim tabs . . . set for take-off, landing gear pressure . . . 750 pounds."

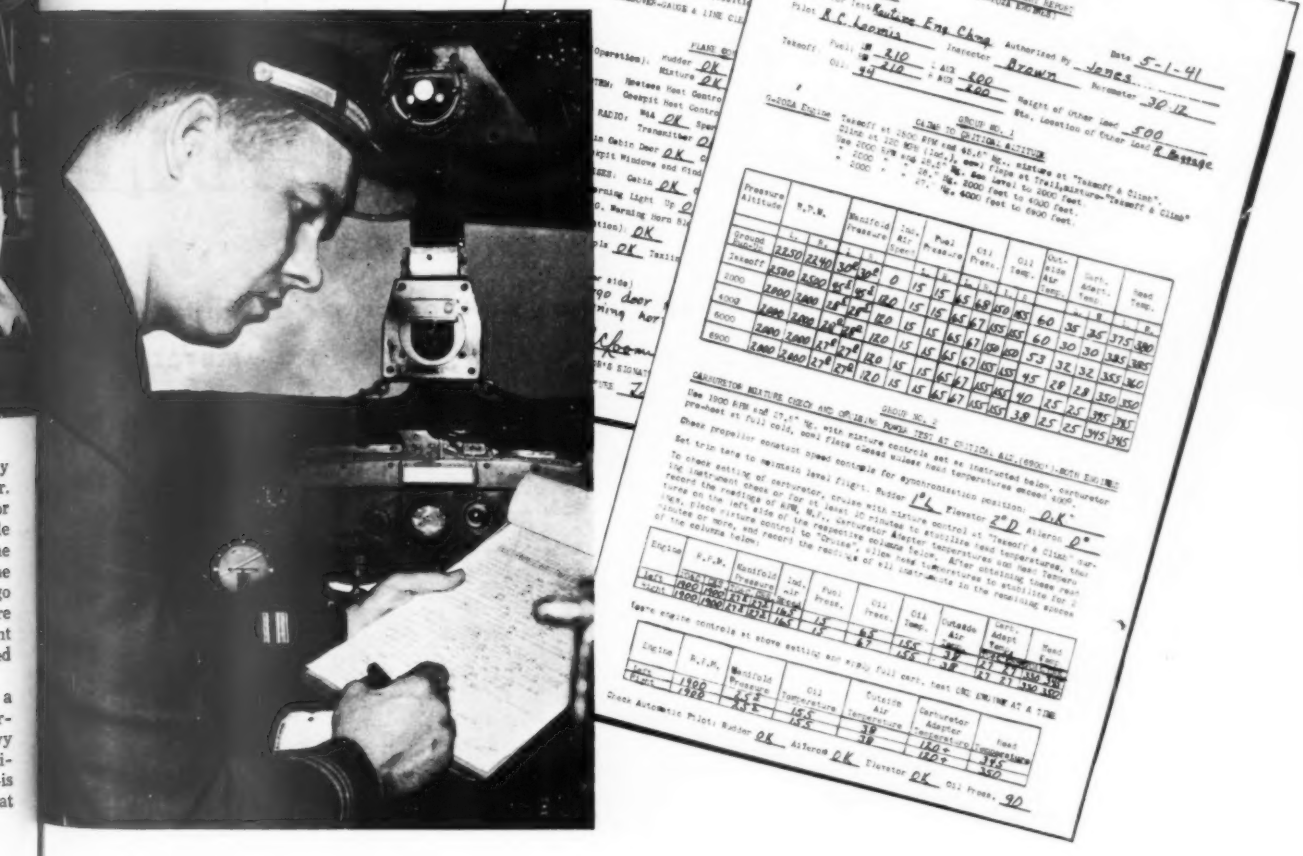
Bob starts the engines and begins the warm-up period. I reach for the mike and obtain the correct time and the indication that the radio is working on our frequency. Switching to 278 kc., I call the Kansas City airport's control tower.

"TWA test No. 357 to Kansas City tower. Ready to taxi out."

"Control tower to TWA 357. Wind northeast two. Traffic taking off north. Okay to taxi to south block. Clearance coming up."

Bob unlocks the tail wheel, revs up the right motor and we begin a left turn. Before reaching the south end of the runway we swerve several times as the operation of the right and left brake is checked. At the south block Bob revs the motors to 20 inches of manifold pressure for the final warm-up. The control tower

(*Continued on page 76*)



Bob Loomis completing his report after flight. Note how every flight factor must be checked.

Airline pilots-to-be, these Boeing students get 460 hours of engine study.

FLEDGLINGS' TIMETABLE

by LeROY B. GREGG*

Would-be pilots should follow a definite training schedule. The author, a veteran flight instructor, outlines the advantages.

GOVERNMENT officials and airline executives are considering the possibilities of physical and mental tests to pre-appraise the capacities of candidates for flight training. A famous clinic is attempting to devise such tests for the CAA, and it is reported that the Navy has secured the services of a noted psychologist for the same purpose.

Eventually valid and reliable tests will be evolved to measure the capacities of would-be students. But I doubt whether it ever will be possible to measure the potentialities of the exceptional person by any but the test of time.

The case histories of two students, Joe and John, are illustrative. Both came from homes of moderate wealth. Both had completed two years of college prior to registering at Boeing School. Both had earned B average grades. Of the two, John seemed the most promising pilot material. He learned easily and always appeared poised, relaxed, confident.

The procedure used at that time (prior to the publication of the CAA Manual No. 50) was to give students 12 to 16 hours under the hood in the Link Trainer followed by 10 or 12 hours under the hood in actual flight before any contact flying was permitted. By the time John had 10 hours in the Link Trainer, his instructor said he was ready to continue his training in the air. After a few hours under the hood in a plane, his flight instructor reported that John didn't have what it takes to make an airline pilot.

That report called for a change in instructors. Personality conflicts develop in flight training as in all other instructor-student relationships. The second flight instructor also recommended that John be washed out. A third instructor confirmed the judgment of the others. They were agreed on his essential weakness. He might perform a maneuver 20 times in a row successfully and blunder on the next trial—not terribly, but badly enough to cast a doubt on his basic competence.

As nearly as Boeing School officials could analyze his weakness, he would concentrate occasionally on one factor of a problem to the exclusion of the other factors. When moving through the air at 100 or more m.p.h. a pilot has no time to concentrate—he must be able to see and

* Leroy B. Gregg is supervisor of flight instruction, Boeing School of Aeronautics.

to evaluate properly all the factors of each problem *instantly*.

When John had logged 35 hours it was evident that he had achieved his maximum skill. That maximum wasn't enough. There seemed no change in his demeanor. He continued poised, relaxed, at ease when at the controls, and confident—too confident. Instructors advised him to give up the idea of becoming a pilot. He argued, and asked for further training. Cost to him was not a factor. He continued until he had logged 100 hours. Then, for his own good, the school washed him out.

The last time I talked to John I pleaded with him to quit flying, to interest himself in some other vocation. But he was an all-too-common type—he would not acknowledge his limitations, even to himself. He went to another part of the country and continued his training. A few weeks ago, a plane he was flying went into an inverted spin. John must have concentrated for a moment too long on recovery to the exclusion of the other factors. No one will ever know.

I always will wonder if any test could be devised that would have revealed that weakness of John's. It was a latent weakness; one that was not apparent in the first hours of his training. Time in the air brought it to the surface and made it apparent to his instructors.

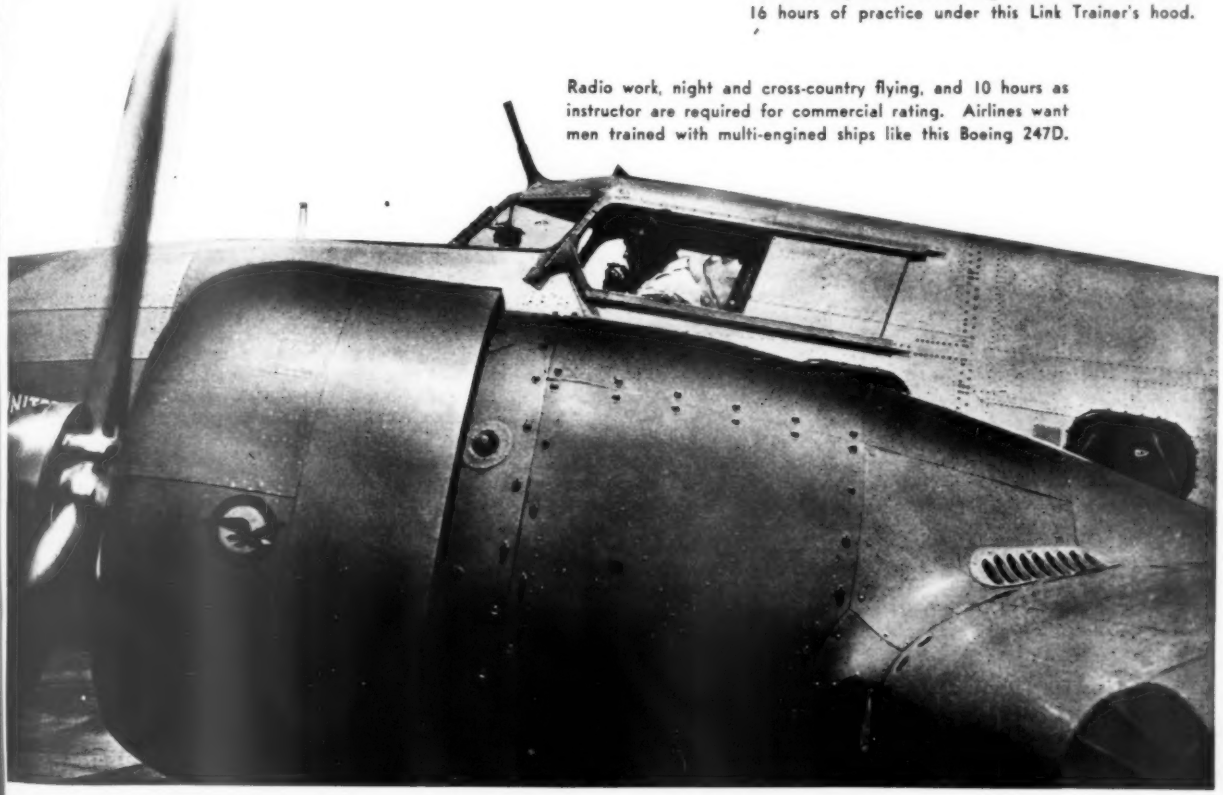
The other student, Joe, was handicapped by traits that would have disqualified him immediately if he had been pre-judged on the basis of the new psychological tests. He couldn't assimilate a new idea quickly. He was stubborn to the point of insubordination. He would never open his mind to the second idea of a series until he was satisfied regarding all the facets of the first idea. Instructors couldn't follow his peculiar mental processes. He had his own way of attacking problems. He was not polite to instructors who tried persuading him to accept a ready made solution.

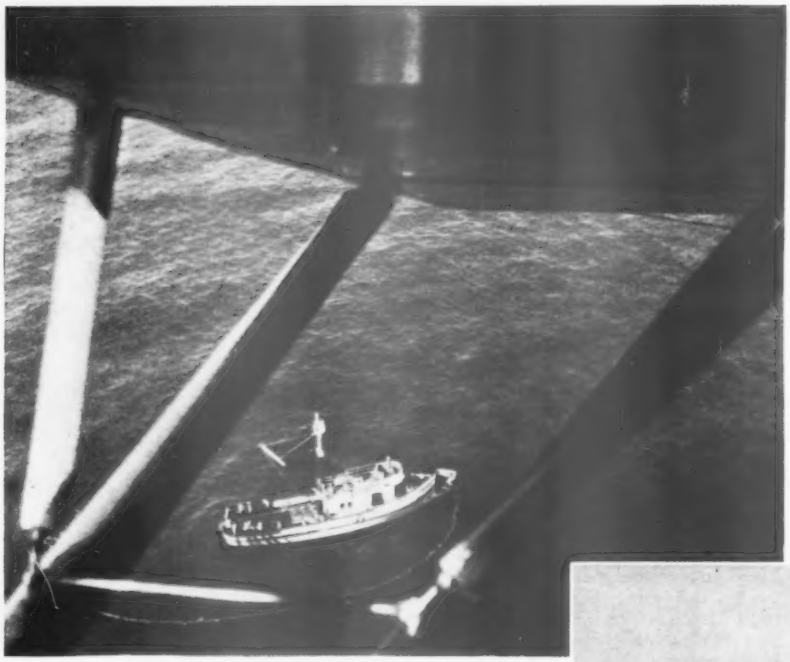
Slow, stubborn, brusque! He required excess time in the Link Trainer and we debated whether we should permit him to take the next stage. We gave him the benefit of the doubt. He took longer than usual under the hood in the trainer planes. But toward the end of this stage of his training, his assurance and skill began to increase noticeably from lesson to lesson. It was evident that he had mastered, in his own way, the fundamentals of flight. Thereafter his progress was something to marvel about. When he graduated he elected to go to work as a first officer under one of the most exacting airline flight

(*Continued on page* 58)

Before the CAA issued Manual No. 50, Boeing required students to precede actual flight instruction with 12 to 16 hours of practice under this Link Trainer's hood.

Radio work, night and cross-country flying, and 10 hours as instructor are required for commercial rating. Airlines want men trained with multi-engined ships like this Boeing 247D.





Flying wardens watch purse-seiner crew hauling in nets. Officers must check on use of illegal nets and fishing in closed areas.

Fish Patrol

by McDONALD WHITE

California's wardens are reducing fishing law violations and gathering valuable conservation data by using a 65 h.p. lightplane to supplement regular patrol boats.

Pilot Earl ("Salty") Bacon (left) and Fish-and-Game Warden D. E. Glass with patrol's newly-purchased Luscombe at plane's Mines Field base.

TWO miles off San Pedro harbor, Warden T. W. Schilling observed a slick wake trailing out behind a freighter 3,000 feet below his plane. Tapping the pilot on the shoulder, he signalled for a circling dive to get a better look at the ship. Pilot Earl ("Salty) Bacon acknowledged the signal with a nod.

At 500 feet the fish-and-game warden aimed his camera at the ship and its telltale streak of oil. He tripped the shutter. To be sure of a clear hit, he made two more shots. Then, at a lower altitude, he checked the name of the freighter and switched on the two-way radio. In less than a minute he had contacted the nearest surface patrol boat and made his report, concluding with:

"Pick up a sample of the evidence. I shot her!"

Haled into court a few days later, the captain of the freighter pleaded guilty to an ocean-pollution charge and paid a fine of $150, for the law forbids the pumping of ballast, bilge-water or oil, or dumping garbage within a 12-mile limit. Thus does the California Division of Fish and Game, in collaboration with the Coast Guard, protect shores and beaches from obnoxious floating debris.

As an experiment, to determine the effectiveness of an air patrol and to augment the activities of land operations and patrol boats, California fish and game authorities lately have chartered a landplane for use by wardens stationed at the State Fisheries Laboratory at Terminal Island, adjoining San Pedro.

The first three months of operations with the chartered landplane proved so successful that, on March 1, the charter was renewed for three months more. At the end of this period—if the plan continues to meet the approval of officials—the Division of Fish and Game may purchase a plane to be used on patrol duty from the Mexican border to San Francisco.

At first the purchase of an amphibian was considered. Such a ship could be set down on the water and arrests made on the spot, rather than calling up a patrol boat. But tests made during the first three-months' period proved this plan impractical, mainly because ocean landings in a light amphibian are, at best, hazardous. Therefore, it could be used only in an emergency.

The plane being used today is a Luscombe Model A, with a 65 h.p. engine. Specifications for a new plane will include such items as an engine of at least 65 h.p., two-way radio, sensitive alti-

meter, turn-and-bank indicator, landing lights, dual ignition, brakes, compass, tail wheel, shockproof panel and an aerial camera.

The advantages of a fish and game air patrol, never before tried on the Pacific Coast, are manifold. For example, a trip from Los Angeles Airport, or Mines Field (where the plane is based), to the Mexican border, thence north along the coast to San Francisco, makes an easy day's run. The return trip could be made the same day, if necessary. Ordinarily, the warden and pilot wait over until the following day for the return patrol.

This speed factor gives wardens a clear picture of activities along several hundred miles of coastline. It is proving the most effective and quickest means of acquainting wardens with a topographical understanding of their territory.

One warden, after his first day on air patrol duty, said: "I learned more about my territory in one hour up there than I could have learned in six months on land or at sea with the old-time methods."

At first, of course, air duty was a thrill for the men. All wardens scrambled for the chance to fly. Now they all get their turns, because the experience gives them such a different conception of the magnitude of their territory. They invariably return with new enthusiasm for their jobs.

"It's pleasure with a purpose," a warden remarked one day to Inspector C. H. Groat, who is in charge of the marine patrol at Terminal Island.

As Inspector Groat pointed out, the flying patrol involves a new technique of law enforcement that must be learned by daily training in the air. Wardens must learn to watch for all kinds of law infractions, major or minor. When in doubt, they instruct the pilot to drop down for closer inspection. If photographs are indicated, pictures are made on the spot. There is no better evidence in court than a good picture.

In addition to spotting and getting pictorial evidence on ocean-pollution cases, flying wardens can locate the working areas of commercial fishermen. If found operating with illegal nets or in closed areas—as in the waters off Catalina Island (reserved for sport fishing) or Santa Monica Bay, or within the two-mile limit off the Santa Barbara and San Luis Obispo County coastlines—a radio call brings a patrol boat to arrest the offenders.

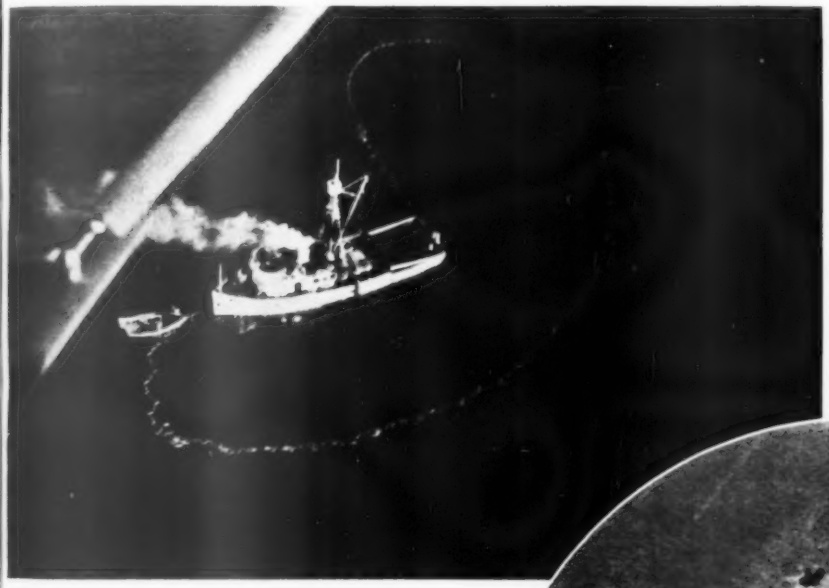
Usually there is a fast boat in the immediate neighborhood, such as the *Broadbill*, stationed at San Diego; the *Bonito*, at Newport; the *N. B. Scofield*, at Los Angeles; the *Marlin*, at Catalina Island; the *Tuna*, at Santa Monica; the *Perch*, at Sacramento; the *Bluefin*, at Monterey, and the *Quinnat*, at San Francisco. These are motor vessels, cruisers and launches and vary in length from 40 to 100 feet, with speeds up to 30 knots.

When the plane is working in a particular area, usually the master of the nearest patrol boat has been advised in advance and is cruising nearby. When a law infraction is observed from the air, a patrol boat answers the summons immediately. Otherwise, wardens would have to rely entirely upon photographic evidence for the issuance of a warrant.

When in doubt about the distance from shore that a commercial fisherman may be operating, the pilot and warden can measure the exact distance by taking compass bearings, then timing the run to shore at a known speed.

Although the purpose of the patrol is speed in apprehending violations of navigation and fish and game regulations, many other observations are proving valuable. For example, schools of fish or bait easily can be spotted from the air. Their location and approximate size are recorded in the daily log made out each day by the flying warden. This information is available to fishermen and is used for research work.

Schools of fish do not remain long in one location. Knowledge of their whereabouts and the direction in which they are travelling makes the job of locating them relatively simple, as most fishing boats are radio-equipped. Also in the log is recorded the movements of sea lions, with their approximate numbers. This information is of interest to commercial fishermen who, as a group, hate sea lions with a vengeance because they destroy nets and fishing gear. Fishermen think twice before setting valuable nets in the vicinity of hungry sea lions. Frequently they shoot the animals at the



Channel Island fishermen sometimes operate 30 or 40 miles out to sea. The fish patrol's plane follows.

Ship's wake betrays garbage or oil dumping, illegal within California's 12-mile limit.

risk of paying a $500 fine for the offense.

Periodically a sea lion census is taken and the use of the patrol plane is expected to speed up the job of locating migrating herds and large colonies in the island rookeries. As a follow-up, patrol boats assigned to this detail take workers to these spots for a closer, more accurate count.

Other duties of the flying patrol will be to observe and record the locations of large flocks of waterfowl, to keep a check on the activities of clam diggers, lobster fishermen, sword fishermen and abalone divers. In each case there are open and closed seasons when the fish, mollusks and crustaceans may be taken legally. There are also strict regulations as to size, numbers and limitations on the type and length of nets used.

Circling high one day over a lobster fisherman who was pulling his traps, Warden Schilling recognized him as a bootlegger who consistently kept the "shorts" (less than 10½ inches long, from nose to tip of tail) and who sold them illegally instead of tossing them back. Schilling motioned for the pilot to circle the fisherman a while to see if any shorts were being thrown back. But the fisherman, recognizing the plane, merely stood up in his skiff with his hands clamped on his hips, leering up at it. Once, when the plane dipped low, he tried to hit the plane with an undersized lobster. When the plane finally departed, the fisherman doubtless thought he had outsmarted them.

But in the meantime, the warden had sent a radio message to headquarters. Two shore wardens were dispatched by automobile to catch the man when he landed the shorts in a secluded cove which was known to them. This lobster bootlegger was ordered to appear in court next day, where his cockiness cost him a $50 fine.

Each year after the lobster season closes on March 15th, a survey is made by patrol boats of the coastline from Mexico north to Point Concepcion. The purpose is to destroy any traps left in the water. Curiously, these traps, if allowed to remain at the bottom of the ocean, are responsible for a vicious cycle of death and destruction. Sheepshead enter the traps to devour the lobsters and are unable to escape. When they die they themselves furnish bait to attract more lobsters, which trap more sheepshead and so on. The cycle never ends until the trap distintegrates. Thus, by flying low over the rocky lobster fishing grounds, wardens are able to locate the markers quickly, some of them partially submerged and relay their position to the patrol boats.

Before the last season closed, lobster fishermen learned to recognize the fish and game plane, although it has no insignia on its wing. When sighting the plane overhead, lobstermen tossed shorts overboard with great flourish. Sometimes they heaved the "bugs" high into the air so there could be no doubt about their good intentions. From a commercial standpoint, the California spiny lobster population is decreasing at an alarming rate, largely due to the illegal traffic in shorts. Lobstermen know that game wardens are bearing down on this phase of fishing.

Another time Warden D. E. Glass was on air duty. He and Pilot "Salty" Bacon were cruising over Pismo Beach, famous for its big, luscious clams. Spotting a man digging along the wide, open shore, Bacon landed on the beach nearby. Never dreaming that game wardens would come popping out of the sky to get their man, the clam-digger only glanced up casually and went on stuffing under-sized clams into his sack.

The man and his clams were brought before the local justice of the peace. The

Warden T. W. Schilling wears inflatable life-jacket provided for safety at sea.

judge pronounced a stiff sentence, reminding the defendant that this was not his first offense.

"Well, your honor," concluded the clam-digger in his own defense, "I've been warned by them fellers on the patrol boats, I've been chased up the beach by land wardens, but I'll be doggoned if I ever expected to see them hoppin' out of the sky to get me!"

Keeping up with the activities of commercial fishermen often requires a trip of considerable distance out to sea, sometimes as far as 30 or 40 miles, particularly around the long chain of Channel Islands—Coronado, Catalina, Anacapa, Santa Cruz, Santa Rosa and San Miguel —where fishing and lobster trapping is extensive. Occasionally, landings are made on some of these lonely island areas, usually to test wind currents and possible landing spaces for an emergency.

Should motor trouble develop while over the ocean, they would have only their two-way radio and inflatable air jackets to protect them. If their altitude was insufficient for a glide to shore, their first act would be to radio headquarters and the Coast Guard for help, giving their position as closely as possible. While awaiting the forced landing they would inflate their air jackets. However, to eliminate every reasonable possibility of disaster, the plane and motor receive periodic check-ups and overhauls.

Patrolling at night has proved impractical because of the poor visibility of objects below. Fishing boats cannot be seen unless their riding lights are burning—and even then it is difficult to obtain a clear conception of distance and position. Knowing that purse-seiners occasionally launch night raids on schools of sardines in restricted zones, particularly off Catalina Island, attempts have been made to locate the scene of their operations with the airplane quickly. But this is not very effective because of trouble in determining their exact positions. So night work continues to be the job of patrol boats and night flying practically has been abandoned.

Not all flying is done along the coast or at sea. As plans develop, more and more observations demanding quick action will center inland, largely in the mountainous areas and over lakes and rivers. Here an amphibian, capable of making a safe landing on lakes or rivers would prove invaluable, wardens believe.

Once, when Game Warden Tate Miller and "Salty" Bacon were cruising over the Salton Sea area toward sundown, they observed unusual activity at the mouth of the New River. Dipping down to get a closer view, they saw three fishermen in a skiff who appeared to be laying a net across the river. Since the use of nets in rivers is illegal at any time, their suspicions were aroused.

Radioing headquarters, Miller reported their observations. State Game Warden Leo Rossier and County Game Warden E. M. Mackey were dispatched to the scene to investigate. Secreting their car in a clump of trees, the wardens kept an all-night vigil, surprising the three poachers when they returned at dawn and commenced hauling in the net.

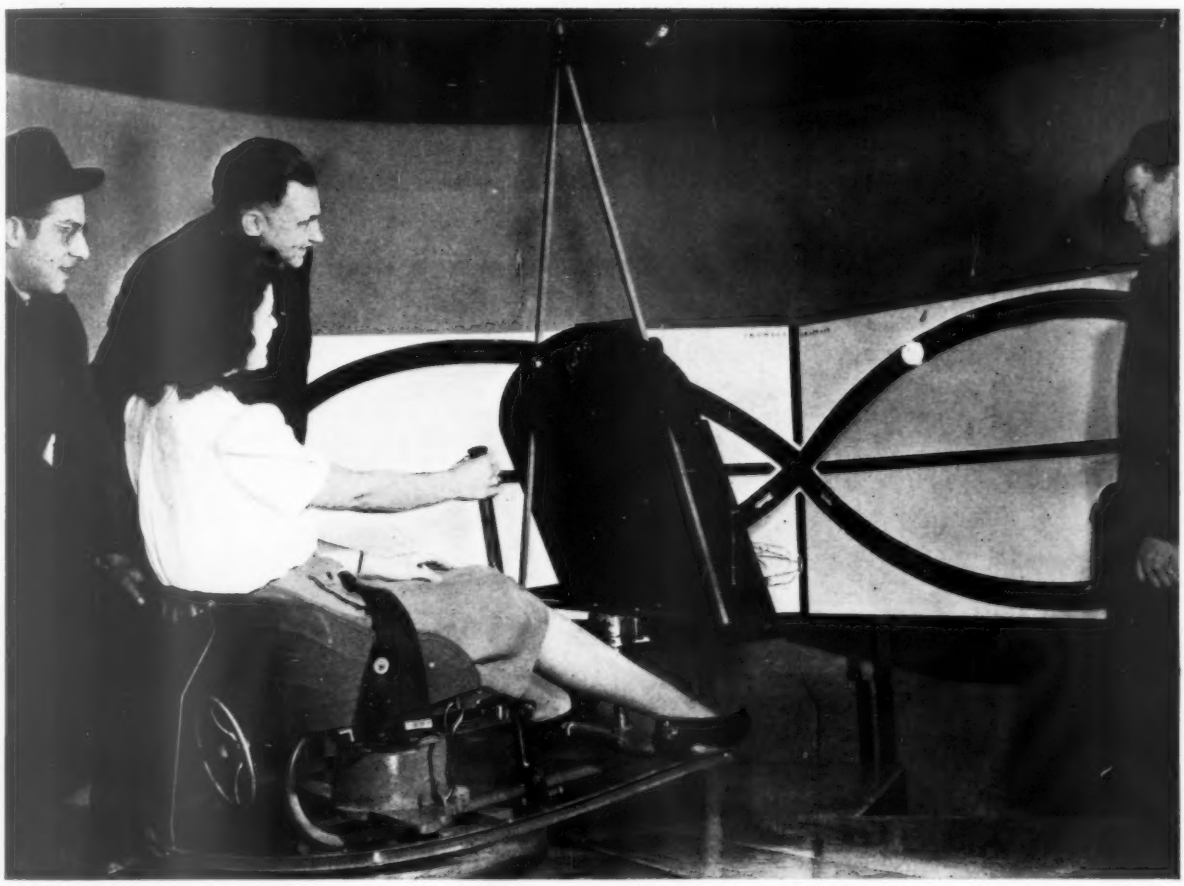
Two of the poachers were second offenders, and were fined $500 each; the other man was released after paying a $100 fine. As a further safeguard to prevent an immediate repetition, the judge ordered their skiff, outboard motor and 400-foot net confiscated. The illegal catch, consisting of some 250 pounds of assorted fish, was turned over to the sheriff to be consumed by inmates of the county jail.

Since the inauguration of the flying patrol only a few months ago there has been a noticeable reduction in fish and game law infractions. Purse-seiners, lobster fishermen, clam-diggers and abalone divers who consistently violate the law soon learn that the wardens who ride in that little plane mean business.

When all the persistent law-breakers learn they can't beat the combined efforts of the land, sea and air patrol, then conservation of natural resources will begin to be more effective than ever. That's why fish and game wardens are now policing from the skies.

END

Flight for the Groundling



Crowell (hatless) shows girl how to handle controls so light beam follows lines.

by E. D. Ward

The Crowell primary trainer—cheap, light and portable—is an important step toward solution of our pilot production problem.

THE frantic scramble of the last year-and-a-half to turn out airplane pilots in hundred gross lots has developed many primary training problems which have hampered production of flyers. Until recently civilian pilot training was a risky financial undertaking. Instructors were loath to go deeply into debt to buy new equipment. The Civilian Pilot Training Program changed all that.

Instructors were re-rated. The incompetent, the flashy and the unfit were weeded out. Accident quotients nosedived and produced favorable press notices. Students flocked to airports for instruction in larger numbers than ever before. The Army, geared to peacetime Air Corps needs, was unable to handle the expansion, so it designated certain schools as primary training centers for cadets. For the first time in many years commercial operators were like the old lady who lived in the shoe. Instructors found themselves short of planes, short of hangar facilities, short of adequate assistants to handle classes.

The Navy, whose training needs are so specialized it cannot farm out new cadets to established schools, had to revise its training methods somewhat to accomodate a sudden increase in numbers. It needed airplanes and more airplanes.

Air services found the Link Trainer, which is used on the ground to teach instrument flight, satisfactory for primary training, but it cost more than most light training planes and was far too much of an investment simply for basic training. Besides, it hardly could be produced in great enough quantity to satisfy the military branches' demands, the Civilian Pilot Training Program, with its goal of 50,000 private pilots a year, and the rapidly growing number of citizens who want to fly just for fun.

Watching this situation grow into what looked like a nasty stoppage point in national defense channels was John E. Crowell down in Charlotte, N. C. Crowell couldn't hold back a broad smile as he contemplated the troubles of the nation trying to expand the reserve of pilots like a balloon. He had been waiting since 1933 for this. He made up his mind to go to New York, there to see officials of the Link company.

Years ago Crowell developed a machine for primary flight training that could teach one much about flying before he

(*Continued on page* 86)

Skilled women workers (inset) calibrate Sperry gyro horizons at company's Brooklyn factory. This device indicates climb and bank. The automatic pilot co-ordinates directional gyro and gyro horizon.

The vitally important automatic pilot installed on instrument panel of United Air Lines Douglas DST.

Miracle Merchants

by WILLIAM WINTER

Sperry Gyroscope Corporation's almost-human aerial navigation equipment is making imminent the day of the push-button pilot.

WILEY POST didn't fly solo on that world-girdling hop. He had talked the Sperry Gyroscope Company into selling him "George", their new—and untested—automatic pilot. Sperry agreed to install the gadget in the *Winnie Mae* on condition Post would say nothing if it failed. But by the time the *Winnie Mae* was a speck over the Siberian vastness, George was doing most of the work.

Wiley just tied a wrench to his hand. Every time he'd doze the falling wrench would snap him out of it. He'd pick up the wrench, check the instruments and pass out again. "George" enabled Post to beat the previous Post-Gatty record of eight days, 15 hours, 51 minutes by fully 21 hours. Post's flight sold the major airlines on the Sperry automatic pilot.

The robot pilot's spectacular debut is not the Sperry way of introducing a new product. They prefer to spot a need, solve

New inventions are tested in Lockheed "14" flying laboratory, which supplements Garden City research headquarters. Sperry engineers keep five years ahead of production.

Sixty-inch high intensity searchlights, another Sperry product valuable to aviation. Each has 800,000,000 beam candlepower. Properly directed, light is visible 200 miles.

it quietly—with an invention, if necessary—and then confidently unveil the perfected product. Before radio beams, beacons, or emergency landing fields, Sperry's visualization of their powerful searchlights as a guide to night flying planes led to the opening in 1923 of the Chicago-Cheyenne night mail route. Airport lighting followed. Blind flying, next Sperry objective, was achieved with the gyro horizon and the directional gyro. Combined, they are the modern automatic pilot's basis. Sperry's new automatic direction-finder, installed by TWA, Braniff and American, gives continuous indicated bearings when tuned on a radio station and eliminates 180 degree ambiguity.

The ingenious and still experimental Flight Ray combines visually on a single instrument face airspeed, directional gyro and gyro horizon readings and position relative to the radio beam. Automatic take-offs and blind landings may be duck soup for Sperry's sensational Klystron tube now being developed. But let's pass up the gadgets for the moment and consider Sperry, the corporation.

The Sperry Corporation has four principal units: Sperry Gyroscope, Inc., Brooklyn, including Sperry Gyroscope, Ltd., of England; Ford Instrument Company, Inc., Long Island City, N. Y.; Vickers, Inc., of Detroit, Mich.; and Waterbury Tool Company at Waterbury, Conn.

Ford Instrument makes fire control apparatus for the fleet's guns. Vickers, Inc., includes Waterbury Tool Co., manufacturers of hydraulic variable-speed transmissions and hydraulic variable-stroke pumps for warships and industrial uses. Vickers' small compact hydraulic pumps and transmissions are used in 150 industries and have many applications to aircraft.

Sperry Gyroscope produces, in addition to its aeronautical equipment, a brilliant array of items, such as the 800,000,000 candlepower searchlight; sound locators; and the Sperry universal director that coordinates the locators, lights and range finders to aim and fire anti-aircraft guns; marine gyro compasses; marine gyro pilots; and other devices too numerous to list.

Sperry Corporation employs 17,000 people in 16 plants. Earnings in 1940 were $7,854,000. Twenty-five per cent of the Sperry Company's business volume is in aircraft products. This contrasts with $455,000 profits in 1933, the year Sperry broke away from the old North American combine, which included TWA, Wright Aeronautical, Curtiss Aeroplane and Motor, Berliner-Joyce, Curtiss Airports and others. Shipments for 1941 will top $100,000,000. Sperry Corporation is owned by 25,074 voting trust certificate holders, who possess 2,016,000 shares of stock worth $85,000,000. Dividends in 1940 were $2 a share, compared with 25 cents a share in 1934. The firm has more than $150,000,000 in unfilled orders.

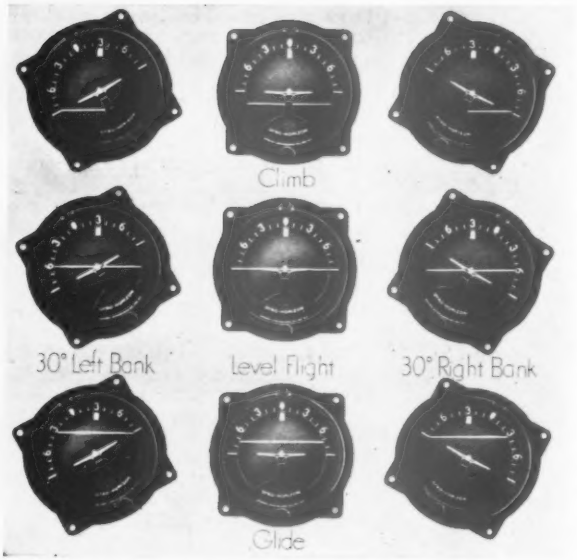
Sperry has four fields of activity in addition to aeronautics: first, anti-aircraft; second, confidential Government work; third, hydraulics; and fourth, marine equipment. Anti-aircraft and confidential work each outrank aircraft. But certainly both these fields overlap aeronautics. Production figures are strictly hush-hush.

However, 5,000 directional gyros and gyro horizons are turned out monthly. Directional gyros bring $325 to $350 apiece, gyro horizons $375 to $425. Over 100,000 of both instruments have been sold. About 5,000 automatic pilots have been produced at $3,600 to $5,000 per unit. Thirty-five per cent of the machine tool load has been shifted to the shoulders of 50 smaller subcontracting organizations.

Sperry has an industrial preparedness plan copied from the government's famous M-Day plan. With this exception: Sperry threw its plan into high gear four years ago. At that time they surveyed plants theoretically capable of turning out Sperry subcontracts and placed small educational orders. Today Sperry leads a phalanx of subcontractors that are meeting all defense demands for its intricate products.

To simplify this set-up Sperry adapted a military concept, classifying positions as line, functional staff and general staff. Line positions deal with primary production functions, such as engineering, manufacturing and sales. Functional staff positions advise and assist other positions; general staff are executives' assistants who act for their superiors. Authority and responsibility are determined by four basic manuals: Organization (responsibility); Standard Practice (rules and operating procedures); Salary and Wage Administration (required skill and characteristics for each occupation); and Accounting (specifying distribution of operating expenses by responsibility).

Heading Sperry Corporation is able, square-jawed Tom Morgan, who came up the hard way. He's a flesh-and-blood Horatio Alger hero who worked his way



Photos show how gyro horizon indicates climb and bank changes.

through high school. Now he sits on top of the world in a swanky Radio City office at $100,000 a year. Born in Vance County, N. C., on September 27, 1887, he was educated at Littleton, N. C., high school. From 1908 to 1912 he served in the Navy. Married, he has a son, Tom, and a daughter, Mary. His diversified activities and achievements get him 28 lines in *Who's Who in America*.

Teamed with Morgan are two former North American Aviation, Inc., men, John Sanderson, vice president and treasurer; and Thomas B. Doe, vice president. Reginald E. "Foxy" Gillmor is president of the Sperry Gyroscope division. Elmer A. Sperry, the elder, one of the world's most famous inventors and scientists—he held 380 patents—died in 1930 after selling out his interests in 1928 for $4,000,000 to return to his beloved experimenting. Lawrence Sperry, his son and a famous airman, drowned in the English Channel in 1923 following a forced landing in his tiny Sperry *Messenger*. It was Morgan who advised against Sperry's dropping aviation activities after Lawrence Sperry's death. In 1929, when he became president of the Sperry Corporation, Morgan made avation a major Sperry division.

It was in 1896 that Elmer Sperry brought home a toy gyroscope for his three sons. Like the proverbial father with the kid's trains, Sperry monopolized the toy. Its peculiar properties teased his inventor's brain. Why couldn't the spinning gyroscope's fixed resistance to displacement be put to work? Fifteen years later Sperry came up with the first successful gyro compass, installed in the *U.S.S. Delaware* in 1911. Chief electrical officer on the *Delaware* was Ensign Reginald Gillmor; chief electrician, Tom Morgan. Old-timers at Sperry recall an amusing story about that *Delaware* demonstration.

With Elmer Sperry that day on the *Delaware* was Hannibal Ford, his chief engineer and now president of the Ford Instrument Company. Gillmor quickly caught on to the gyro compass' possibilities. Morgan, always practical, buttonholed Ford. How come the gyro compass gave automatic correction for change of course, speed, and latitude? "Simple," said Ford, and rattled off an impressive trigonometric formula. But it was only after numerous explanations with Sperry as the earth's rotation and Morgan as the center of gravity that Morgan began to see the light.

From that ship's compass to airplane automatic pilots and gyro compasses was only a step. In 1914 Lawrence Sperry took a gyro-controlled Curtiss seaplane to France to capture a 50,000-franc French Aero Club award for a safe flying device. Altimeters, drift indicators, landing lights, gyro driven turn-and-bank indicators, and the Sperry *Messenger* baby biplane followed in rapid fire succession. Night flying and subsequent developments already have been mentioned. Airplane soundproofing was an incidental job.

"Gulliver among the Lilliputians", one financial report called Sperry, for the firm's heavy investment in research and engineering brains have kept it ahead of competition. Sperry will compete on one basis only: engineering. The joker is that Sperry has amassed overwhelming engineering talent and production skill in precision instruments.

"The tougher the problem, the better we like it", is the Sperry axiom. And Sperry tackles and beats problems no sane manufacturer would even consider. When Sperry finds a product easy to make and competition creeping in, it axes the product. Although most Sperry patents have expired, there are no challengers. One story tells about a certain banker who dropped $1,000,000 in an abortive attempt in the marine field.

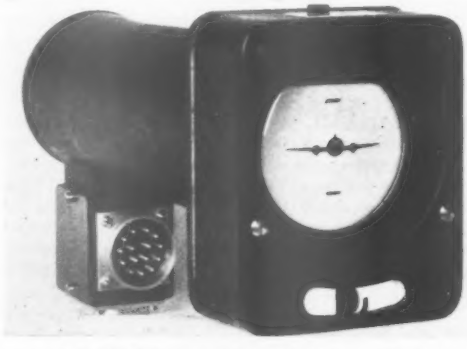
Thomas A. Morgan

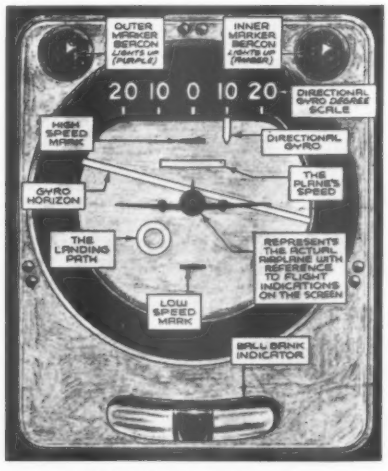
Sperry puts it this way: "One of the reasons we've been able to make such good progress is that we carefully observe the old adage, 'Shoemaker, stick to your last'. Success and security in success depends upon ability to accomplish something with superlative skill. We have defined our scope as the development and manufacture of instruments and accessories for naval, military and aeronautical purposes, preferably patentable and involving problems of sufficient difficulty to discourage the irresponsible and unintelligent competition which makes the average business of our size insecure."

Sperry machine tolerances run as fine as 1/100,000 of an inch. The materials for the $350 directional gyro cost but 39 cents; the balance, labor. After watching Sperry Gyro craftsmen at work in the 11-story Brooklyn beehive, we'd say their well-earned near monopoly stems from an extraordinary *esprit de corps*. "Human engineering", as Tom Morgan labels internal policy, works wonders for Sperry. Your Sperry man knows he can go to the biggest company executive at almost any time. "Tell your boss what you are doing. Then go ahead", is the rule here. Sperry engineers are strictly on their own. Sometimes they'll disappear for days at a time. But results are expected—and obtained.

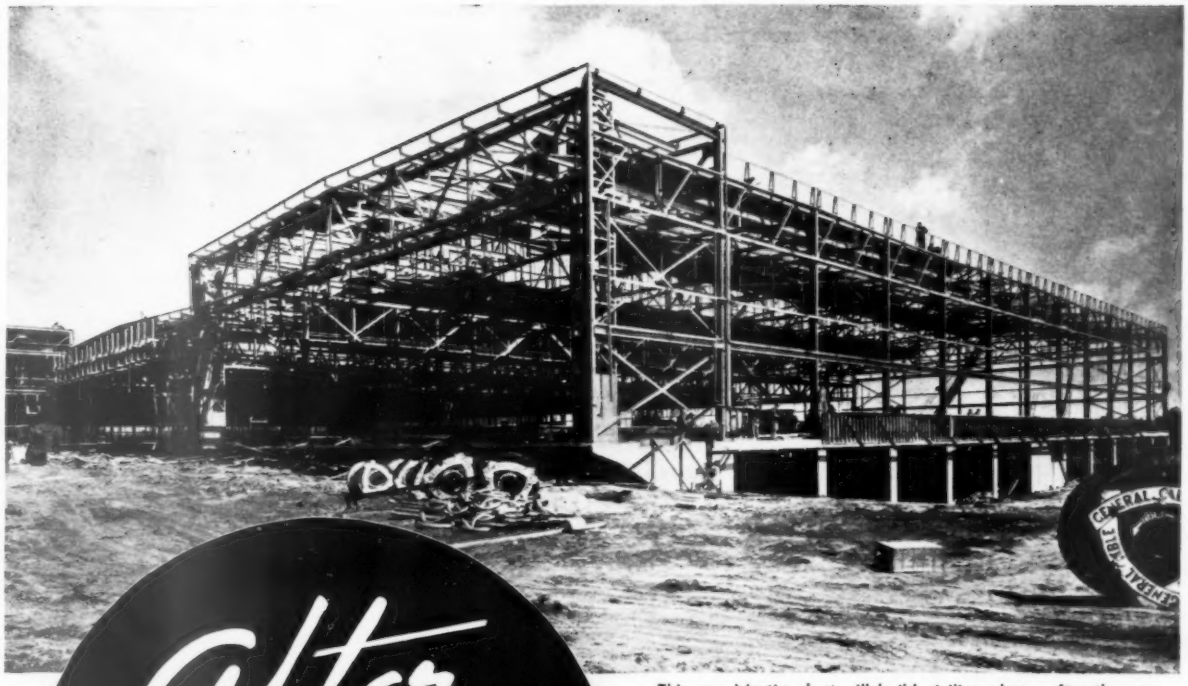
Fortune magazine once commented: "Sperry engineers' work is ceaselessly in progress with those minor miracles in which the company deals." Even now,

(*Continued on page* 68)




OUTER MARKER BEACON LIGHTS UP (PURPLE)
INNER MARKER BEACON LIGHTS UP (YELLOW)
20 10 0 10 20
DIRECTIONAL GYRO DRIFT SCALE
HIGH SPEED MARK
DIRECTIONAL GYRO
THE PLANE'S SPEED
GYRO HORIZON
THE LANDING PATH
REPRESENTS THE ACTUAL AIRPLANE WITH REFERENCE TO FLIGHT INDICATIONS ON THE SCREEN
LOW SPEED MARK
BALL BANK INDICATOR

This Flight Ray, coupled with the new Klystron tube, will simplify blind landings. Cathode ray tube (extending from dial, left) projects flight data as symbols on screen, as shown in diagram at right.



This new Martin plant will build civilian planes after the war.

After the War...?

by Thomas H. Corpe

Commercial and pleasure planes to meet new public demands will pour from America's war-expanded aircraft factories when peace comes.

Thomas H. Corpe became assistant general sales manager of Lockheed Aircraft Corporation in June, 1940. He previously had held other executive posts with the firm and its affiliate, Vega Airplane, as well as with General Motors. Educated at England's Oxford University and our own University of Michigan, he served in both Canadian and Royal Air Forces in World War I. One of the Allies' foremost aces, he had 22 enemy aircraft to his credit. He was awarded the Military Cross, the Distinguished Flying Cross and the Croix de Guerre.

TWO questions most frequently asked by visitors to an aircraft factory these days are: "How many planes are you turning out?" and "What's going to happen to your business, with all of this expanded floor space and extra equipment, when the war is over?" We know the answer to the first question but daren't tell. We believe we know the answer to the second, and here it is.

I say "we believe," because anyone who is called upon to speak for the aircraft industry must do so with certain misgivings. No business in the world is moving so fast or changing so phenomenally. Many planes become obsolete almost as soon as they are first built. Architects design, and contractors build, new hangars or assembly and fabrication buildings. Often they are too small and bulging over with planes and personnel before the first pay-checks are issued.

Despite this swiftly changing picture, I can say that what we believe we also believe in—and the industry is convinced that beyond the red horizon of blood and bombs there lies an era of peacetime commercial, transport and pleasure flying which may be compared only to the automobile industry.

Thomas H. Corpe

In 1939, the aircraft industry ranked far down the list of industries in Los Angeles County. Today, we are told by the Chamber of Commerce, we rank first. We employ more men than the oil refining, tire manufacturing, auto assembly and motion picture industries combined. Twenty years ago, we did not exist. The National Defense program has placed us in the midst of the greatest developments in the history of aviation.

The assets of the predecessor of the present Lockheed Aircraft Corporation were purchased nine years ago for $40,000. In 1940, the value of planes and

(*Continued on page 66*)

FOR THE FUTURE

GROENHOFF

Richard Johnson, 17, sailed this "Baby Albatross" into third place at Elmira meet.

By COMMANDER EUGENE F. McDONALD, Jr.

The soaring plane can become to America what it has meant to the German air force, if far-sighted American youth has his way.

Youth can do as much for aviation as it has for radio, says Commander McDonald.

I AM not an authority on aviation. Although I have followed the industry's development closely for many years, my personal flying is strictly amateur. It is somebody else's job to calculate wing loadings and aspect ratios. However, I am convinced that aviation is on the threshold of greater progress than it has ever known, because our sudden interest in soaring has brought flying to American youth on a scale that was never before considered remotely possible.

I feel that I am an authority on youth. I know the creative ability and sublime enthusiasm of eager youngsters. *Everything we have in radio today is due to the youth of the United States.* Impetuous youngsters, who did not know that there were rules about how things should not be done, tried unorthodox stunts and made the basic discoveries which our engineers have refined into the radio of today. Most of our engineers are graduates from ham ranks. Some of them still come down red-eyed in the morning after nights spent in their ham shacks.

What youth has done for radio it can and will do for aviation. The sport of soaring is launching active glider clubs throughout the land. It is a matter of youthful enthusiasm and money just as it was in radio. Youngsters in every walk of life could afford to buy the inexpensive parts needed to start them off in radio. We lead the world in radio because we encouraged them to experiment; we made

Some of the sailplanes and pilots attending a recent National Soaring Contest at Elmira. Home-made gliders have shattered records.

them licensed operators, gave them our blessing and told them to go ahead. They did the rest.

Youth has contributed mightily to aviation. Unfortunately, the youngsters in this country have not been given an opportunity to perform the marvels they have done for radio. There are probably 20 teen-age kids building and flying models for every one that burns his fingers soldering wire to condensers, but there are nearly as many licensed radio amateurs as there are licensed airplane pilots of all types. The explanation for this is simple:

In radio the boy can go on progressing from his first key and buzzer through the intermediate stages to a first-class license and a well-equipped shack, and still stay within his budget. He meets no insuperable barrier to stop him cold and divert his interest to other channels.

The boy who starts building model airplanes has a different experience. Sometime in his later teens he will begin to lose interest in models. They have served their purpose, taught him a great deal about the theory of flight and led him to an intense interest in real planes. But they are only toys.

A fortunate few have been able to move on to powered flight but the great majority are stymied when their last model goes into the trunk with other discarded toys. They don't have the money to take lessons and buy an airplane, they are too far removed from aviation centers, their parents are afraid to have them fly, they lack the necessary two years of college for CAA courses, or they are too young. The great majority are diverted from aviation, most of them never to return. By the time they are old enough to overcome the barriers which stopped them, they have acquired other interests.

Here is where soaring enters the picture. It provides the ideal connecting link between model-building and power flying. Its economy, even at present relatively high costs, is enough to put it within reach of most boys who can build and fly models. Its safety will appeal to parents and to youth organizations interested in promoting clean, safe sport for adolescents. Its need for teamwork and cooperation provides ideal character training. Its practical value in later power flight is axiomatic to all commercial pilots who have also had soaring experience: men like Lewin Barringer and Capt. Shelly Charles of Eastern Air Lines. Old-time flyers who now are prominent in aviation circles, such as Capt. Eddie Rickenbacker, Maj. R. W. Schroeder and Maj. Al Williams agree that soaring instruction will make a man a better power pilot.

My faith in the creative ability of American youth is the result of practical experience. The parallel between the accomplishments in aviation and radio seems very clear to me.

It is more than 20 years since I joined two young radio amateurs, Carl Hassell and Ralph Mathews, to enter the radio manufacturing business. I had a little capital and several years' experience in selling and financing automobiles. They had the creative ability typical of radio hams and—all important—a license to use the inventions of another ham, Edwin H. Armstrong (now famous as the inventor of FM). We were so ham-minded that we even coined our trade name, Zenith, from the call letters of their amateur station, W9ZN. Since then Zenith always has been ham-minded and found it very profitable.

In the early 20's when radio was young, hams were allocated the commercially

(*Continued on page 94*)

Born March 11, 1890, at Syracuse, N. Y., Commander McDonald has been in the radio business since 1920. At present he is president of Zenith Radio Corporation and a number of other firms. A lieutenant commander in the U. S. Navy in 1917-18, he still holds that rank in the Naval Reserve. He has been a leader in several Arctic and archaeological expeditions and is a member of the Explorers Club and a fellow of the Royal Geographic Society. He was educated at Syracuse University.

The author (center right) landed 90 miles south of El Paso.

Pilot-STRAY NOT INTO MEXICO

by RALPH H. MINER

Landing your airplane south of the border without advance permission is a passport to trouble, says this flyer who tried it.

DID you ever start on a carefully planned cross-country trip and have it turn into more adventure than one might expect in 10 years? Well, through an unforgettable error in navigation, just such a thing happened to me.

In the early summer of last year two friends and I, all of the engineering department of North American Aviation, decided to fly to Georgia for our vacation. My two friends, Tom Clancy, also a private pilot; and Joe Fisher, a passenger, both have their homes there—and I was going for the fun of flying. We rented a brand new Stinson "105" from the Stinson Flying Company of Los Angeles Municipal Airport. On the late afternoon of July 12, 1940, we took off for Yuma, Ariz., our first stop.

With a slight tail wind most of the way, we arrived in Yuma just at dusk for an elapsed time of two hours and 10 minutes. After servicing and hangaring the ship we spent a hot, rather sleepless night in Yuma and took off for Tucson, Ariz., at 5:30 a. m. the following morning. We landed in Tucson at 8 a. m. and, after servicing the ship and obtaining the weather report, we took off for El Paso, Tex., via Willcox, Ariz.

We had not intended to stop at Willcox, but headwinds were so severe we calculated a ground speed of only 60 m.p.h. So to insure our fuel supply we landed and filled the tank with five gallons of aviation gas obtained from a garage man in town about half a mile from the airport.

We then followed a compass course which intersected the railroad about 20 miles southeast of Lordsburg, from which point we took another fix. All this time we had been crabbing into a cross headwind of between approximately 35 and 40 m.p.h. After making good this fix—about 80 miles west of El Paso—I did not make proper allowance for our crosswind and obtained our new fix on the wrong mountain peak.

My mistake was in being so cocksure of our fix that we flew for about half an hour before realizing our ground points did not check. We then realized that we were off our course but knew we were near El Paso. We had better than an hour and a half's fuel supply at this time and knew if we swung our course to northeast we would pick up the railroad leading into El Paso or, positively, the Rio Grande.

After less than half an hour we reached the railroad, but it so happened that we were about 15 or 20 miles south of El Paso and did not realize that fact at the time because our heading at this point checked approximately with the railroad heading north of El Paso. So we followed it south. After a few miles we discovered our points and heading did not check, so we followed the railroad to the nearest town to check our exact location.

Upon circling the town, we could find no name and, therefore, being unable to determine the exact distance to El Paso we decided to land, figuring it best to use some of our remaining fuel supply to se-

lect a field carefully. The field we chose turned out to be a small dry lake bed about half a mile from the edge of town. We knew we were landing on Mexican soil, but had no alternative.

Now from here on, you pilots who may some time be flying courses near the border, read carefully and take heed.

I believe it can safely be said that 90 per cent of the U. S. pilots do not fully realize the seriousness of landing on, or even flying over, Mexican soil without proper documentation from the Mexican government. I most certainly did not know it then, but through an experience which I hope you will avoid, I know now.

The town near which we landed was Villa Ahumada, a small Mexican village about 90 miles south of El Paso. We hadn't been on the ground more than 10 minutes before we were arrested by the local police and immigration officials.

At first it was difficult to make ourselves understood, because we found but two young brothers in the town who could speak English. The boys were the sons of the mayor who, it seemed to us, was the only straightforward official in the town. He was a true example of cultured Mexican hospitality. Incidentally, he owned one of the local bars and, over it, had the broken prop of the last pilot he had helped.

The first thing we did after putting a police guard around the ship, to keep away a hundred or so curious Mexicans, was to wire the American Consulate at Juarez, explaining the situation and giving him the license number of our ship. Knowing the number of the ship, he told us later, saved considerable red tape. It was Saturday afternoon and the consulate offices were closed, but we hoped that the wire would reach the consul's home.

After two hours of waiting, we received no answer. We then composed wires to send to the home airport, telling them that everything was okay. When we tried to send them the operator closed his office for the week-end and pretended not to understand us. There seemed to be an undercurrent among most of the local officials to keep us there. They had stalled for an hour and changed the price three times before they even sent our wire to the American Consulate. There was no telephone and we were not permitted to use the railroad's communication system.

As the town was quite poor, we were given our choice of spending the night in jail or of paying the local police to guard us. We most definitely chose the latter and were given the freedom of the town under guard.

The following morning the conductor of a train dropped off a wire for me from the vice-consul at Juarez, stating that negotiations for our release were under way. The local immigration men were receiving their information over the railroad telegraph. They told us that the Mexican customs chief was personally on his way from Juarez to inspect the ship. He arrived about noon.

Through an interpreter he asked us practically all of our lives' history, then proceeded figuratively to take the ship apart. We had to do some mighty fast talking to keep him from slicing the upholstery to see what was behind the rear seat, but we finally succeeded in convincing him that it was not a compartment. He then released us to the United States and, upon reaching same, we were to notify the vice-consul of our safe arrival.

We were elated at being allowed to leave after such a short time, but this turned out to be only the beginning of events. We purchased five or six gallons of the best white gas the town had to offer and strained it into our tank, figuring that being mixed with the three or four gallons of 80 octane already in the tank, it would be satisfactory. Upon starting, the engine ran quite smoothly but, after a 10-minute warm-up, would turn up only 2,200 r.p.m.—not enough power for our load.

While reading this, keep in mind that the minimum altitude of this country is about 4,000 feet. So it was decided that I fly the ship to El Paso, service it and be ready to go when my friends arrived on the bus. I took off with flaps half down and after clearing the high brush at the end of the field, with not too comfortable a margin, some difficulty was experienced in climbing. I had only about 150 feet altitude, so I left the flaps up by spilling the air as slowly as possible.

I then began having mixture trouble. I had adjusted this before taking off, but evidently the fuel feed was not to be depended upon. My r.p.m. suddenly dropped and started me on my way down. After some rapid experimenting, the engine seemed to run its best on full rich. Some excellent updrafts were found off the slope of a mountain range on my course, and I finally attained an altitude of almost 8,000 feet (above sea-level).

By this time I had been up about 20

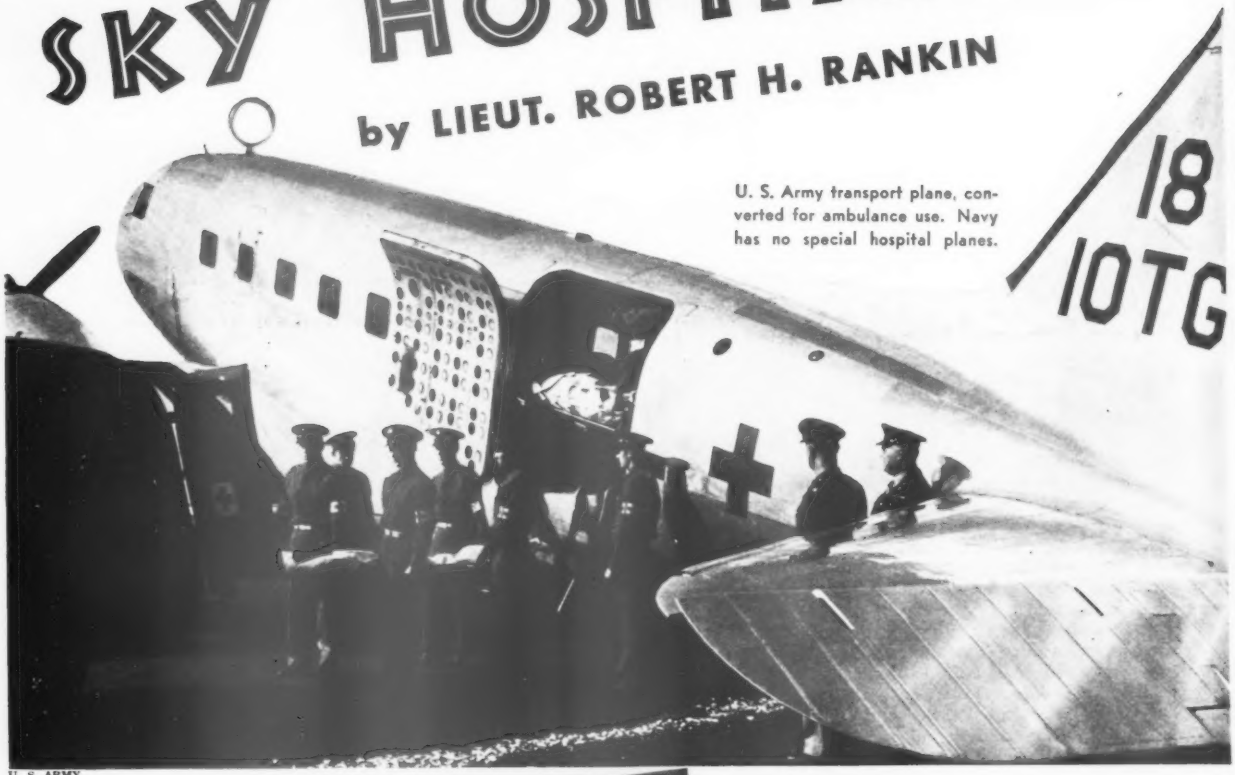
(*Continued on page 74*)

Ralph Miner (left) explains to Mexican Federal police that he landed on highway—thus violating law—because forced down by engine trouble. Man at right, U. S. vice-consul, helped all he could.

Author and friend in Mexican desert "taxi" after their forced landing 90 miles south of El Paso. They found themselves trapped in network of red tape. Notice Stinson in background.

SKY HOSPITALS

by LIEUT. ROBERT H. RANKIN



U. S. Army transport plane, converted for ambulance use. Navy has no special hospital planes.

U. S. ARMY

U. S. ARMY

Doorway's large size makes easier placing aboard of wounded, brought to plane in field ambulances.

Vitally important to the modern military force is the ambulance plane. Our Army now has the best.

MILITARILY the airplane usually is thought of as a weapon. Today it actually is becoming an increasingly important means of allaying pain and suffering through evacuation of war wounded by air.

Probably the first time planes were used to transport wounded soldiers was during the Serbian army's retreat in 1915. No special provision was made for carrying the wounded. The emergency demanded that they be evacuated and they were flown as passengers.

During the first World War badly-wounded men sometimes were flown to adequate medical attention behind the lines. Here again the wounded were carried as passengers, without special provision for their comfort. Then, in 1920, the French army in Levant used the air-

U. S. ARMY

Stripped of regular equipment to leave maximum space for stretchers and medical facilities, ambulance planes' aisle allows attendants to care for patients while in flight.

plane to evacuate some 80 cases. The machine guns and their mountings, together with the seat, were removed from the rear cockpit. The cockpit opening was enlarged to admit a stretcher. When an epidemic of dysentery broke out among the British troops stationed in Kurdistan in May, 1923, more than 198 acute cases were transported safely for 100 miles to Bagdad's military hospital. Here again, the suffering men were carried in conventional military planes slightly modified to admit a stretcher. This was so successful that air squadrons operating in Egypt and Mesopotamia were equipped to carry stretchers.

The first real progress was made in 1921, when the French air service secured the first craft designed especially for ambulance work. Of conventional biplane design, its roomy cabin was so constructed that two stretchers could be carried easily. There was sufficient room for a doctor and a nurse to move about and perform minor operations. Shortly after this, the British army put a modified Vickers *Vernon* into operation. Two stretchers were run on rails through the nose of the fuselage. Wicker seats for eight patients were provided and an ice box, sanitary and medical supplies and extra stretchers were included in the ship's equipment. A pilot, a doctor and a first-aid attendant were carried also.

In 1925 a Breguet "flying hospital" was adopted by the French air service. A biplane job, this craft had an extra large cabin fitted with a large skylight. A large door fitted into each side of the fuselage insured easy loading of stretcher cases. Equipment included electric heaters and sterilizing apparatus, medical instruments and supplies. This ship was an agent both of evacuation and treatment.

The U. S. Army Air Corps has paid considerable attention to wounded soldiers' evacuation and ambulance aircraft development. One of the first practical ambulance planes our Army tested was the Cox-Klemin XA-1. An equal-span biplane, it had an enclosed cabin which carried stretchers and medical supplies. The pilot was seated in an open cockpit. Although this craft pointed the way for later ambulance ships, its lack of power and limited weight carrying ability reduced its usefulness.

A definite step forward was the Army's Fokker ambulance (Y1C-15). A modification of the single-engined Fokker parasol monoplane, it provided roomy and comfortable carrying for stretcher cases. This ship demonstrated the flying ambulance idea's soundness and showed what could be done with conventional commercial transport modifications.

Recent developments have given the Army a practical and efficient ambulance from the DC-series Douglas transport. This bi-motored, efficient, weight-carrying monoplane is ideally suited for the purpose. Interior fittings have been removed or modified to permit Naval-type stretchers' installation. They are attached securely to the fuselage to prevent swaying and jolting, yet they may be removed readily when transporting patients. Accommodations are provided for a medical attendant or medical officer. The cabin is roomy enough for an attendant to move about along the stretchers and attend patients. Complete medical and surgical equipment is carried for treating patients while in flight. An extra-large door in the fuselage side allows easy and rapid stretcher removal. Although the War Department will release no performance or design data, this Douglas flying ambulance is known to be superior to any other nation's. No information is obtainable as to the Army's plans for evacuating wounded men. Experiments have been conducted, however, and definite practices laid down.

The U. S. Navy has no flying ambulances, utility and transport planes being pressed into service when needed.

The Spanish Civil War and Germany's invasion of Poland and France involved successful aerial evacuation of the wounded during actual combat. Further developments are being made in the present war, but strict military censorship bars reliable information. The French made little or no use of the airplane in caring for the wounded. Just what the British army has developed is unknown. The Germans have studied the problem and have established a complete system.

(*Continued on page 96*)

Germany developed efficient air ambulance service during Spanish Civil War. Junkers Ju-52 transports were used. They have reduced death toll in successive Nazi campaigns.

ACME

THE LIBRARY

AERIAL VAGABOND

by Bessie Owen, with a foreword by Prince Bibesco, president of the Federation Aeronautique Internationale. Liveright, N. Y. 1941. 256 pps. 37 illustrations. $3.00.

Bessie Owen, one of the country's best-known flyers, is a San Francisco woman who, just prior to the start of the Spanish civil war, casually embarked on an airplane tour of the world. She owned a four-place Waco and had an impressive background in long-distance flying. Neither of these advantages helped her much in the constant battle with senseless official red tape which gives this book much of its appeal. She was grounded for weeks at a time while police and secret-service agents tried to build up spy cases against her. American vice-consuls usually got her out of these situations. She did not help matters much by photographing the German concentration camp at Dachau, flying over hastily-built military construction, circling over well-placarded military areas with her ever-present camera. Her Waco suvived the trans-Gibraltar flight over miles of water with a weak magneto; lost its tail-wheel in Spain and staggered across Europe on gasoline which left mud, bits of wire and thick sediment in the chamois strainer. Eventually it reached Shanghai in a state of complete collapse. The starter did not work, it had no landing-gear shock-cords, the cabin ventilators were jammed, the ailerons were tattered and the engine was leaking oil. But the vermilion paint job, she says, was superb.

She sold it in Manila and returned on a Pan American clipper. The book is a delightful recital of the exasperations of such an ambitious tour. It is almost like a diary, one which pilots everywhere may read with enjoyment.

SO YOU'RE GOING TO FLY!

by James L. H. Peck. 227 pp. and appendix. Dodd, Mead & Co., N. Y. 1941. $2.75.

On his acknowledgment page Mr. Peck thanks this magazine for permission to reproduce certain material which has appeared in our pages. Readers who have followed Mr. Peck's articles in FLYING AND POPULAR AVIATION will note that he has amplified his magazine subjects a great deal in this volume.

The work is divided into three major parts: learning to fly, advanced flight technique and the special demands of military flying. Each is discussed thoroughly but without elaborate technicalities. The aspiring pilot is introduced to the physical requirements for flight training in the first chapter and then to the

(*Continued on page 97*)

Standard Terms for Navigation

by Comm. P. V. H. Weems

THERE has been a natural tendency to apply mathematical terms and expressions in the solution of wind drift and other navigation problems. For example, to designate the drift angle, the Greek letter "α" (Alpha) has been used, with the letters "A," "B," "C," etc., for other parts of the wind triangle. If these designations were purely mathematical, new terms would not be required.

Actually, the special problems in air navigation may be simplified by standardized terms. The U. S. Navy has taken the lead in this, especially for radius-of-action problems. Referring to Figure 1, the abbreviations, "E," "W," "P" and "S" mean a great deal more than the former equivalent terms, "A," "B," etc. These terms refer to the relative movements of the wind, the plane and the observer, thus largely covering the subject of dead reckoning navigation.

Designating the movement of and between objects is best accomplished by

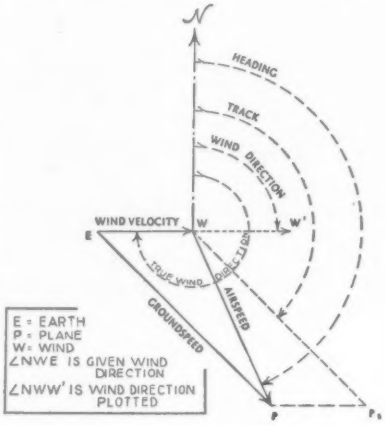


Fig. 1

using a standardized group of symbols which, when correctly combined, are significant of each object's motion (speed and direction).

Let

E = earth
W = wind
P = plane or aircraft

Any object's motion with respect to any other object involved is shown by joining their respective symbols with a vector, the symbol (or letter) at the arrowhead denoting the object which is moving, as follows:

E→W: Speed and direction of the wind with respect to the earth.

W→P: Speed and direction of the aircraft with respect to the wind.

E→P: Speed and direction of the aircraft with respect to the earth.

Adjoining letters are used to designate the sides of any diagram representing a combination of velocities wherein the values are represented by the indicated side's length being proportional to the speed, while the side's slope indicates its direction.

In accordance with the principles of a triangle of velocities, an aircraft's speed and direction relative to the ground may be said to be the resultant of two velocities: the movement of the aircraft through the air due to the power which propels it; and the movement of the air itself, or the wind.

If an aircraft were to fly from one point to another in still air it would be subject only to its own velocity and would travel

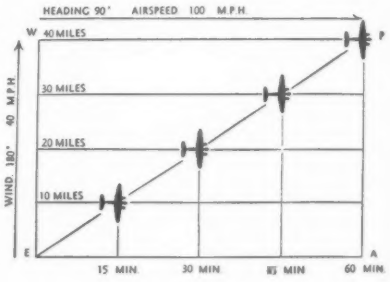


Fig. 2

in a straight line between the two points at a rate of speed equal to the aircraft's airspeed. The aircraft's position at any time would be known as the "no wind" position. Should the wind be blowing in the same direction in which the aircraft is flying (i.e., a tailwind), the aircraft's speed over the ground would be increased by an amount equal to the wind's velocity. Should the wind be blowing in the opposite direction to that of the aircraft—a headwind—the aircraft's speed over the ground would be decreased by the amount the wind is blowing. When the wind is blowing across the heading of the aircraft, from any angle, the aircraft will be driven from the line of flight in the direction toward which the wind is blowing and by an amount equal to the wind's speed.

Information concerning the speed and direction of the wind always is given as follows:

(a) The direction of the wind always is given as the direction from which the wind is blowing.

(b) The speed of the wind always is given in miles per hour, in either statute or nautical miles per hour (knots).

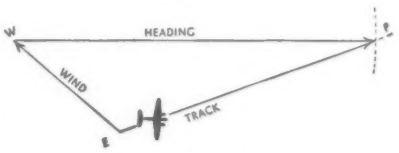
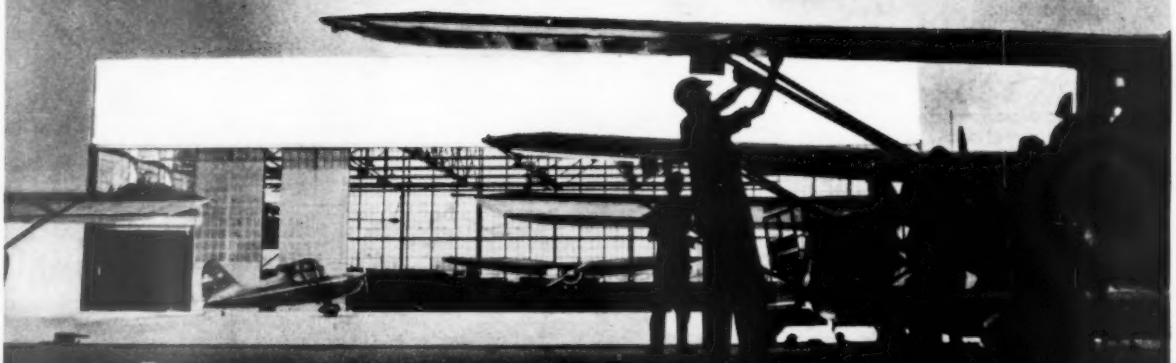


Fig. 3

Wind 180°, 40, means the wind is blowing from 180° at a speed of 40 m.p.h. The effect of such a wind on an aircraft which is heading due east at an airspeed of 100 m.p.h. is illustrated in Figure 2. An aircraft attempting to fly from point E to point A under the foregoing conditions would be driven from its course by the

(*Continued on page 102*)

How Safe Is Your Plane?



By DWIGHT SWAIN

Careful servicing and maintenance are your best anti-crash insurance. These 310 CAB-analyzed crackups show why.

DO you want to be a maintenance accident statistic? Yes? Then class daily inspection as a waste of time, disregard manufacturers' bulletins on airplane care and insist that, while others may crash, it can't happen to you. Friends and family sooner or later will point to the "fatal" column under "extent of injury" and say, "Yeah, that's him. He was this year's number seven. His ship's listed with 'washouts,' too."

If you prefer to keep your health and plane intact, on the other hand, reasonable care in servicing and maintenance is the best kind of insurance you can carry. Relatively inexperienced people are flying today in tremendously increased numbers. There were 22,983 certificated pilots in 1938, as compared with approximately 65,000 at the end of 1940. Since many of them lack thorough understanding of their ships' needs and functioning, opportunities for trouble have zoomed proportionately. A recent CAB Safety Bureau report, analyzing 310 such accidents as due to poor maintenance or lack of inspection, says that proper checkups would have eliminated most of these crackups. The 310 made up 14 per cent of 1939's 2,210 non air-carrier aircraft wrecks.

How serious are these mishaps? The report shows 16 fatal and 12 serious accidents in the injury columns. Major property damage resulted from 276 of these. Power-plant failures were responsible for 233 of the crashes, structural breaks for 77.

Of the 233 crashes following power-plant failure, 30 completely washed out the ship involved. Ninety-two required overhaul service and 94 major assembly repair. In only 17 cases were the damages described as minor. Nine resulted in deaths, 11 in serious injuries and 28 in minor injuries. Forty-five of the planes were instructional, 141 pleasure and 47 commercial. The pleasure ships accounted for seven of the fatalities and 18 of the washouts.

The second division, aircraft structural failures, made up only 77 of the 310 accidents analyzed. Seven of these crackups involved deaths, however, and nine washed-out ships. Fifteen instructional, 41 pleasure and 21 commercial planes were involved. Again the pleasure craft led the list, with five of the death crashes and eight of the total wrecks.

Fifty per cent of the power-plant ailments centered in the fuel system. Of these 117, 33 were classed as "fuel exhausted" and 21 as "fuel insufficient." In plain English, these pilots either flew until they ran out of gas and were forced down, or else knowingly took off inadequately fueled in the first place, in 54 cases.

"Proper servicing and maintenance would have precluded a failure," the Safety Bureau report states. ". . . lack of elementary flight planning or just out-and-out negligence is often the cause." Typical is the case of a private pilot with 3,300 hours to his credit. Flying cross-country, he ran out of gas and made a forced landing—with resultant major assembly damage to his plane—in a cornfield. Another pilot took off with two pay passengers. In a crash following engine failure, all three were seriously hurt. The ship was a total loss. The cause? The flyer had taken off with a low fuel supply.

Do you always check your gas supply before taking off . . . watch the fuel being poured into the tank or test the level with a clean stick, instead of taking for granted that the gauge is working properly . . . space refueling points so that a 25 per cent gas reserve will be in the tanks when you land . . . make allowances for no wind or head wind conditions in calculating fuel reserves, instead of expecting tail winds to carry you through?

Carelessness in ship servicing was held guilty in 19 instances of water in fuel or fuel line, four cases of inferior gasoline,

24 of clogged fuel line and a number of other fuel system crash causes. Warnings were issued against letting gas tank vents become clogged or using gasoline not designed for aviation engines. "Fuel tanks, tank wagons, ground fuel pits, etc., are often primary causes of power plant failures in planes, due to water or dirt in the fuel," the Bureau declares. The draining of tank wells and strainers to remove water and sediment also was recommended.

Knowing that your own life, as well as those of others flying with you, depends on good engine performance, do you always buy your gasoline from a thoroughly reliable source, then refuel through a chamois equivalent or strainer?

Faulty carburetion got the blame for 28 of the power plant failures—12 per cent. "Water or dirt; jets clogged, loaded with water, or failed" accounted for 14 instances. "Faulty carburetion adjustment" caused six accidents and "float leaking, sticking, or otherwise faulty" caused four. Careful cleaning and inspection of the carburetor's component parts during engine overhauls was recommended. Gascolators and strainers should be drained and cleaned frequently during operation periods.

Thirty-two crackups were caused by defective ignition. Twelve resulted from magneto failures, seven from spark plug difficulties (shorted, wire detached or broken, etc.), four from condensers gone bad and three from battery trouble.

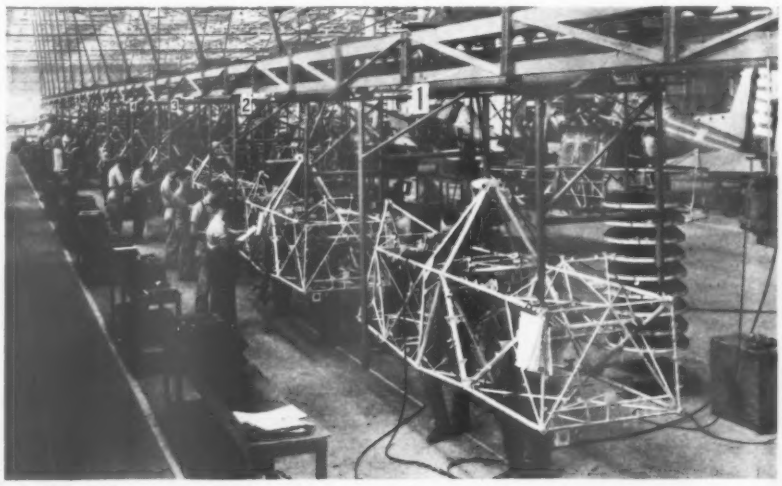
"Ignition wires and battery should be inspected at frequent intervals," comments the Bureau. "Ignition wires not protected by a suitable engine cowl are subject to exposure to rain, air blasts and continuous flutter. Insulation wears where the wires chafe against the engine. Wires in harness often become oil-soaked and worn at the outlets. These faulty wires should be replaced as a protection against failures. Ground wires, especially, should be inspected frequently for loose connections. The magneto and generator should be checked at least every 100 hours by a competent mechanic. During operation, oil should be applied as instructed in the manufacturer's manual. When inspecting the breaker points, see that contact surfaces are clean and free from burned pits and rough surfaces. If spark plugs are properly tested periodically, most of the ignition trouble from this source will be avoided."

Does each of these points receive proper attention on your ship?

The proper quantity and quality of oil for your engine should be used. Never mix different brands. "If the engine is using an excessive amount of oil, . . . have the rings and bearings checked," says the bulletin. "Normal temperatures must be maintained carefully at all times . . . Engines having overhead lubrication should be checked in accordance with instructions." Metal particles in the strainers—which should be cleaned each time the oil is changed—indicate that something's definitely wrong with the lubrication system. Use of a poor grade of oil may form a sludge in the crankcase which eventually will clog the oil strainers.

(*Continued on page* 88)

First Aircraft Conveyor System



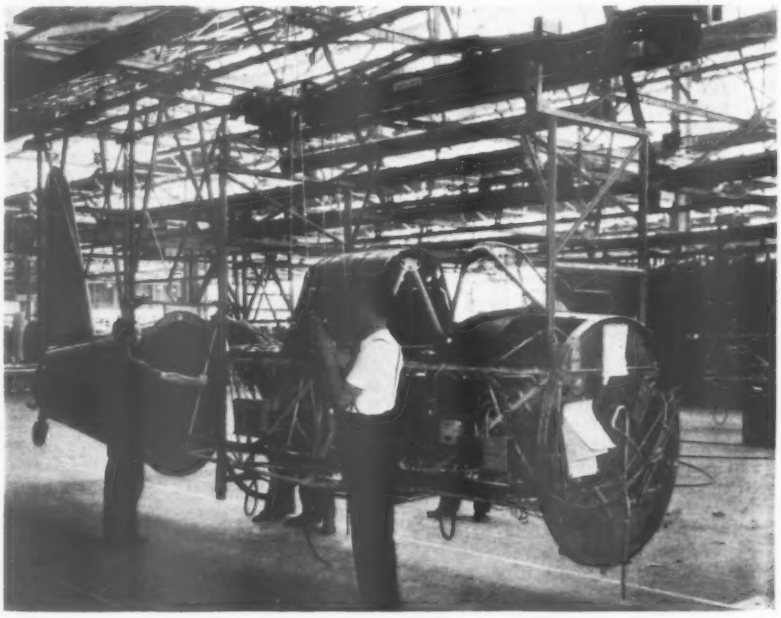
Twenty-five separate crews work on fuselage assembly line. Conveyors move ships.

MORE than a mile of overhead conveyor system carries military planes through production processes on the first powered, mechanized, final assembly line in the aircraft industry. Final assembly time has been cut 50 per cent and required floorspace reduced 33 per cent through it, according to Vultee Aircraft, Inc., the firm introducing the system, while military plane production has increased fourfold.

The final assembly conveyor has 6,280 feet of overhead rail, designed so that every point along it is completely free of machinery and obstructions. Workmen have complete access to planes' undercarriages at all times. Although the conveyor system is confined principally to the final assembly section, feeder lines reach sub-assembly departments to carry completed major units into position. The final line has 46 stations, each with its own crew. Operations at each station are so planned that they are completed in a given period, at the end of which the plane has moved slowly to a new station. To support the various plane parts during assembly, the conveyor line uses 124 carriers, some of the sling type, some equipped with trays and some of the suspension arm kind.

Picture above shows line's fuselage section. This unit involves 25 assembly station. Below is assembly point of complete fuselage and complete tail sections. Note overhead transfer bridge which moves fuselage from its conveyor line to join tail assembly line.

Here fuselage and tail are joined. Fuselage level is variable to simplify bolting.



PROBLEM PILOTS

by FRANK LAMBERT

Alike to the eye, each of these Randolph Field cadets is an individual problem.

Successful instructors, recognizing that each student pilot presents a different problem, vary their methods accordingly.

IN preparation for the present emergency, the Air Corps was quietly increasing its staff of instructors in the spring of 1938. At that time the total number was still very small, and one veteran check pilot was testing every prospective instructor after he had completed his instructor training and before he was allowed to ride with a student. After checking every standard maneuver as hurriedly as thoroughness would permit, the check pilot always spent a few minutes in quiet conversation. If he considered the man acceptable, he always ended the conversation like this:

"I think you will get along all right. Just remember that you have a lot to learn and that *each student is a different problem.*"

He said that to everybody and usually it was remembered. At first it sounded like an obvious statement of no particular significance. The new men could not possibly understand the full meaning of that advice until they had instructed at least two or three classes. By that time they could appreciate what the veteran check pilot was talking about.

Practically every new instructor goes through the same process after his real work of instruction begins. At first, his ideas of how a student learns and how he should be taught are based upon his own experiences as a student. These are well-remembered and, because they are real, they affect his attitude and his approach to his job more than anything else.

At the beginning of his career as an instructor, he is going to think of each student as himself all over again, just as a father likes to think of his son as himself a boy again. This attitude is inevitable. Lacking any other experiences relating to the contact between youth and ignorance on one hand and experience and skill on the other, the parent or the instructor in any field must, of course, begin by recalling his own performances and reactions on the receiving end of instruction.

Up to a certain point this is fine. The instructor's own experiences are an invaluable recollection and naturally they provide him with sympathy and understanding. But beyond that point they may be useless and even definitely harmful. The reason for this is explained easily. Many instructors fail to understand it, however, and their failure to do so is one of the principal factors contributing to their difficulties. The talented instructor, on the other hand, rapidly discovers the great differences that exist in human nature and even in the young men of similar education, background, age and stature. (We will avoid hopeless complication by refusing even to mention the surprising and entertaining varieties of reaction common to flying students who happen to be women.)

The competent instructor soon discovers that some of his students are baffled by problems which have never occurred to him. Others find no difficulty in mastering the details of flying technique which troubled him most. He learns by trial and error that the attitudes and

Instructors must realize that students seldom duplicate their teachers' early problems. These Hicks Field graduates are reporting at Randolph for advanced training.

methods which brought forth his own best efforts are not always effective and he finds out by experiment that some of the efforts which failed completely when applied to him as a student will work very well on certain other individuals.

He is forced to admit that many of his own pet notions and theories about the so-called secret of good instruction are all wet. At the same time, he develops a sort of contempt for the pet theories about instruction advanced by anyone whose notions are not backed up by months of give-and-take on dual controls.

The able instructor learns that he cannot adopt any set attitude or manner of instructing without sacrificing the best interests of those students who do not respond to that type of attitude. He cannot be "hard-boiled" all the time and expect good results from timid students, and he cannot be "easy-going" all the time and expect much from those students who are cocky or careless.

He cannot insist upon perfection of performance from the student who strains for it and he cannot fail to insist on perfection of performance from those students who are inclined to be slipshod. He must not fail to be reassuring to those students who think an airplane is a death-trap and he must not fail to frighten those students who think an airplane is a toy.

The poor instructor, on the other hand, has difficulty with all students, however talented, who are not just the kind of student he was. He is of little help in the solution of problems which never troubled him as a pilot, and he fails even to recognize the psychological difficulties that can arise in a type of personality foreign to his own.

When any student, in all sincerity, tries to explain some difficulty peculiar to himself, all he gets from such an instructor is an incredulous stare and a response which amounts to little more than a shrug. And a clever but untalented student, after discovering this situation, may deceive him into thinking he is always on the verge of accomplishments which are impossible for him.

This type of instructor is at his best only with those students who happen to be like him. If he happens to be slow, methodical, and precise, he may do very well with a student who has the same characteristics. But the quick, brilliant and somewhat erratic type of fellow will have a hard time developing his full talent. If he happens to be a borderline case anyway, he may become discouraged or fail. Unless his system of instruction provides an experienced and understanding check pilot who can guess the reason for such failures, a lad who might have become a fairly competent pilot may have to turn to some other field to achieve success.

The percentage of such cases is small in any good school, but a great many have been enabled to continue as pilots by the discernment of some check pilot or supervisor, as well as by their own confidence and perseverance.

This does not mean that a student's comparative failure under one instructor, and his comparative success under another, is necessarily a reflection upon the ability of the instructor under whom he failed to show satisfactory progress. It must be remembered that as much depends upon the student as upon the instructor. It may be that a change of instructor is just the thing needed to wake a student up and make him get to work. In the case of many sensitive lads, progress may be affected as much by a letter from home, a girl's smile, or a buddy's taunting comment, as by anything an instructor can do.

Athletic coaches cannot take all the credit or blame for the performance of their proteges, nor can flying instructors. Some coaches and flying instructors are necessarily much better than others, but, except in cases of outstanding superiority or obvious inferiority, it is not wise to jump at conclusions. Many bits of evidence are needed. The job of estimating an instructor's ability is considerably more difficult than that of estimating the ability of a student and the instructor's case requires much more time and study.

There is a tendency to become set in one particular attitude or method and to carry on with no pauses for self-examination or self-criticism. No doubt there will always be stubborn or insensitive flying instructors, who think of any student merely as someone who is supposed to "absorb" instruction and not as someone whose reactions must be studied constantly. It requires an effort of will, an open-minded willingness to admit error and a certain understanding of human nature to recognize that methods of teaching which seem logical and have worked in the past have to be modified to fit particular cases. These qualities do not exist in all people, not even in all people who can fly an airplane very well. And this is one of the principal reasons why good instructors are much harder to find than good pilots.

A certain amount of flying ability is, of course, essential. An instructor must be able to handle an airplane as well as an average good student. He need not be as proficient as a brilliant student. It is an actual fact that many of our best instructors today cannot handle a training plane quite as neatly and effectively as some of their own brilliant students.

(*Continued on page* 92)

Mae Wilson (right) explains some fine points of plane construction and wing bracing to two of her student flyers, Beatrice Joyce (left) and Bonita Kay.

MAE'S THE BOSS

by CHARLES A. HUNT

When her husband crashed to a tragic death in 1933, Mae Wilson was forced to take up flying. Today she's a leading aviatrix of the midwest.

YOUR modern Miss America is air-minded. But did you know that some of the country's up-to-the-minute women flyers are instructing the future aces around whom Uncle Sam is building a great and powerful air force?

There's Mae Wilson for instance. Owner and operator of her own airport on the outskirts of Chicago, Mae Wilson today is teaching some 45 young men and women to fly—and already has furnished one cadet to United States Naval aviation and one to the Royal Canadian Air Force.

Mae believes she is the only woman airport operator living who does all her own passenger flying and flight instructing. She has more than a thousand hours of commercial flying in her log book, 600 of them flown within the last year and a half. And although Wilson airport's current flying equipment is limited to a Kinner Bird biplane and a Lambert Monocoupe, she has flown nearly every practical type of plane.

Nowadays it isn't uncommon for Mae Wilson's students to undertake air training with the intention of preparing for some role in national defense. Not so a year ago, however. Then the privilege of guiding a soon-to-be-uniformed aspirant through his first solo seldom befell this woman air instructor.

So it pleases Mrs. Wilson to tell you that Ensign D. B. Dukelow of the Naval Air Station at San Diego, Cal., was the first of Uncle Sam's flyers to test his wings at her airport. She says:

"After a few hours solo Dukelow became a draftsman for Porterfield. Later he entered the Service and now pilots one of the Navy's Consolidated PBY flying boats based in California. He is a native of Hutchinson, Kan.

"L. F. Cuddington of Chicago, who was accepted as a cadet by the Canadian air force, also learned some of his ABC's here," Mae adds.

Eddie Osborn, another Chicagoan, went to Mae "to get in as much flying time as possible" after his acceptance as a United States Naval flying cadet. Osborn was a radio organist before he decided to enter military aviation.

Mae Wilson is active in two women's flying organizations, both of which are dedicated to the national interests in time of emergency. One of these, the Chicago Girls' Flying Club, stages its own air circuses as proof of woman's realistic role in aviation. When it does, this woman airport operator turns stunt flyer and is a featured performer. Stenographers, housewives, telephone operators, cashiers and even an heiress or two are members of the club, which has turned out a number of proficient pilots.

Wider in scope is the international women pilots' organization known as the Ninety-Nines. Mrs. Wilson until recently was one of five governors supervising the Ninety-Nines, her jurisdiction being the north central states. Founded in 1927 with the late Amelia Earhart as first president, the Ninety-Nines has hundreds of full-fledged women pilots as members and maintains headquarters in Washington, D. C. Even a junior member must have flown 10 hours solo, while a section of the roster have piled up more than 200 hours. The group is affiliated with the National Aeronautical Association.

(*Continued on page* 98)

PLANT PLANNER

Arrangement problems insoluble on paper are cracked easily by Meloy with the help of his scale model.

By
KURT RAND

John Meloy's miniature Piper factory has helped that famed manufacturer plan his production facilities economically.

"IT can't be done."

The metal fittings department head wasn't altogether wrong. On paper it couldn't be done. The suggested position for the three lathes in the newly expanded metal fittings department at the *Cub* factory didn't leave room for workmen to stand between them—on paper.

"Now, look here," said the young man from the planning department. He picked up the three big lathes and set them down on the controversial spot. Another quick twist of the wrist and he had placed three sturdy workmen at the machines.

"See?"

There was plenty of room for lathes and workmen—a six foot, 190-pound workman at that—when that single change in the angle of a bench had been effected. No time had been wasted and very little money had been spent.

Piper Aircraft boasts no Mr. Mystic on its payroll. The young man from the planning department handling those lathes and workmen with such carefree abandon was handling lathes made of balsa and spruce weighing a fraction of an ounce and workmen who actually stood less than an inch tall. Both lathes and workmen were only a few of the several hundred miniature parts that comprise the accessories for the scale model of the Piper factory.

At the plant the planning department, a bare year old, has been regarded as something of a problem child. When one of its members—John Meloy, a Penn State graduate—first began the scale model, he was laughed at. Now the problem child has had some tough problems to handle, however, and Meloy's idea has been one of the important reasons why so many of these problems have been cracked successfully.

In stepping up weekly plane output from about 50 at this time last year to over 100 at present, formidable difficulties have been encountered. Although an addition of 40,000 square feet, in the form of two 400-foot assembly buildings, was completed recently, the expansion program has made it necessary to utilize every bit of the original building's floor space. To the planning department has fallen the job of allotting new sections to various departments and of figuring how to cut down on waste space.

In the metal fittings department enlargement meant new machines and new workers. Not all these could be accommodated in the old section. Up the floor was another and larger section that might do. Would a shift be successful? Here the planning department stepped in. Models of lathes and workmen were placed in the model building in the precise positions they would occupy in real life. It was found that both men and equipment would fit, although scale drawings seemed to contradict this verdict. The planning room began to think they might yet laugh last at those who mocked.

The Piper company in miniature went into construction in July, 1940. Meloy, with Tom Baldwin and Howard Brown, under Donald Nichols' direction had been planning mainly "on paper." He had found it convenient to use rough models —cardboard rectangles, scaled to represent fuselages, and small wooden blocks mimicking various machines. These were better than paper, but not entirely satisfactory. Frequently a machine would have a high or low extension that in real life would have made it fit around something else. Rough, squared-off blocks failed to make allowance for such parts. Seeking to rectify this fault, Meloy began carving exact replicas of machines and planes, the process which eventually was to develop into the Piper miniature.

Two young Carnegie Tech men, Jack Phanes and Ben Wectzler, then came to work. They spent several months carving fuselages, work-benches, cowlings, cables and everything else that goes into the manufacture of light airplanes. They made more than 1,000 such tiny parts, everything from stair railings to struts.

Piper actually uses many more parts in a single plane, but it was not necessary, for planning purposes, to carve replicas of all of them. Building continued through January, 1941.

Meloy devoted most of his time to casting leaden men. He made nearly 300 figures, some standing, some sitting. Over 1,200 employees actually are on the Piper payroll, but a small lead man can be moved from welding to spraying zinc chromate to shepherding a sub-deb *Cub* into the assembly line as no human worker ever will be able to do. The original of the workmen that dot the model factory was a company draftsman who consented to donate his husky measurements to the project. No. 1 man of the "little people" is "The Boss," a cast lead figure tilted back in his chair so that his feet rest on his balsa desk. Both "The Boss" and the identical figures that comprise the rest of the workmen were first carved in wax, then cast in lead. Meloy made casts of cement for this purpose.

"When I came to work for Piper, I never thought I'd be able to use the stuff I learned in the foundry at Penn State," he says, "but this is one of their tricks."

The model of the factory itself, built to house the rest of the equipment, is complete except for the new offices, the J-3 paint shop which soon is to be rebuilt and the power plant. With the first and third, "Planning" is not particularly occupied. For the J-3 paint shop a housing model already has been constructed. The entire factory is mounted on a long table whose drawers house fuselages primed and unprimed, planes that are tired of standing in the assembly line, sundry extra equipment and those of the lead workmen not busy that shift.

Since the model factory is built with separate floors, the planning department frequently is seen moving men and machines from here to there on the first floor while the second floor dangles dangerously overhead. It is lifted by means of pulleys and counterweights.

"Toy Shop" is the term applied to the planning department's brain baby by those who laughed. Tom Baldwin decries the name.

"It's that sort of thing which prevents other folks from taking us seriously," he comments. "This isn't supposed to be funny. It has saved lots of time and money."

Tom needn't worry. The term doesn't mean that Piper people don't take the model seriously. They do. But the employees' average age is very young and the workers aren't too busy turning out *Cubs* for enthusiastic sportsmen pilots and national defense work and RAF benevolent funds to quit joking altogether.

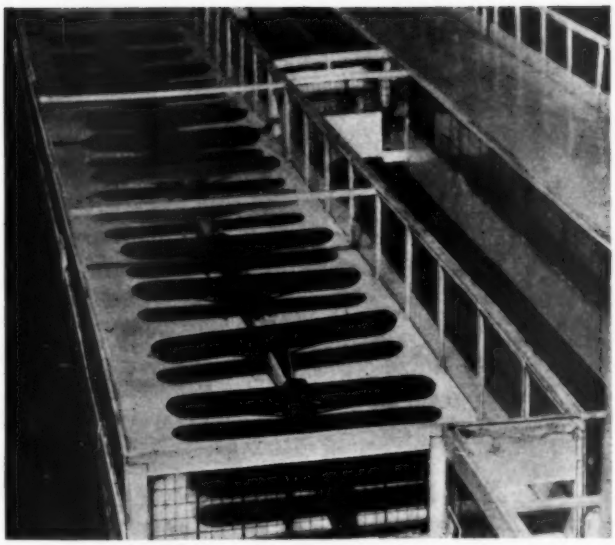
Matters like the recent rearrangement of planes in the assembly line make people regard the "Toy Shop" with ever-increasing respect. Formerly planes were placed in a double row facing the same direction. Someone suggested a large amount of space could be saved by facing one row opposite from the other so that the wings would interlock; it took only a minute to try out the idea on the model. The suggestion proved good and promptly was put into effect. Thanks to the model, no money nor workhours were inefficiently used.

Not only does the model prevent inefficency. Its own construction was inexpensive. Everything used in it was made from factory scraps. Windows were made from scrap pyralin, the material employed in *Cub* windshields. Spruce for machines came from spars. The entire model is valued at approximately $1,500. This counts only materials and the hours that went into its construction.

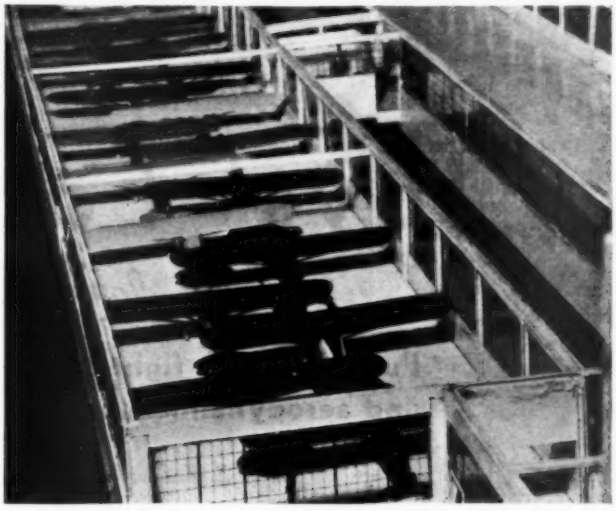
Proof that it is valued beyond $1,500 is shown by the fact that the model is kept high up in the factory's fireproof tower. Although the scale of ¼ inch per foot means that the model is quite small, it nevertheless—what with its table mounting and the pulley for raising the second story—crowds the narrow tower room.

John Meloy now is wondering how the model can be improved to show the factory's modern work methods. There's the monorail which conveys planes with finished covering into and through the assembly rooms, for instance. It keeps each partially assembled plane on its own jig while it moves from one department to another until completion and is to be extended within the next month

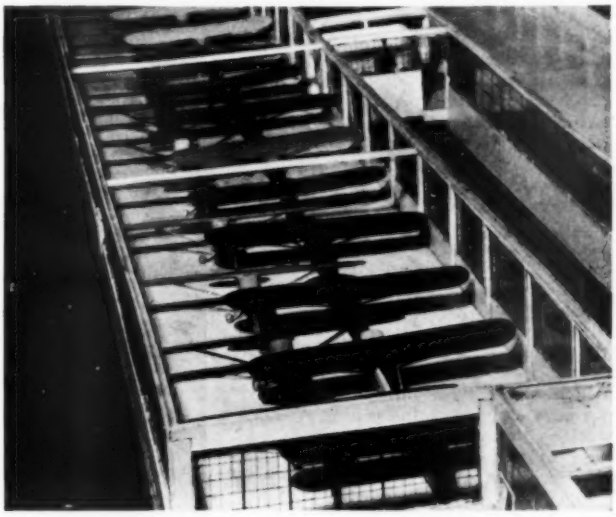
(*Continued on page 76*)



How the models saved assembly line space. Single row of planes, as above, allows 14 ships. Below: plan used by Piper until recently.



The planning department arranged models as shown in bottom picture and found that much space was saved. This is the system now in use.



RCAF officers examine models made by Ottawa Technical School pupils. The little ships are one-twentieth real planes' size.

RCAF

'Toys' For The War

By James Montagnes

Future RCAF fighter crews learn maneuverability and aerodynamics from Ottawa schoolboys' models.

OTTAWA schoolboys are playing an important part in training the pilots, gunners and observers for Canada. Unable to enter the Royal Canadian Air Force because they are too young, these youngsters are preparing themselves to step into the air force as soon as they become 18 years old. But meanwhile they are hard at work making precision models of every type of plane Canadian airmen are likely to use or meet.

In a large room in Ottawa's ultra-modern technical school, a mass-production line has been set up where the boys taking aeronautical engineering make models of 28 different types of British, American, German and Italian types of airplanes. Two partially covered air frames of elementary training planes stand end to end at one side of the room, parts of wings hang from the ceiling, parts of flying models are displayed on boards above the blackboards and a number of solid models of the types now being built by the boys hang from the ceiling. Woodworking machinery lines the walls and long tables make up the assembly line covering most of the floor area.

The making of solid and flying models has been a regular part of the aeronautical engineering course at Ottawa Technical School. So well have the models been made and so many graduates have joined the air force, that the school was asked to undertake the making of models for the training centers of the air force in all parts of Canada. Production was started at the beginning of 1941 and has averaged about 35 fully-completed models weekly since then.

The Royal Canadian Air Force has given the school a standing order for an unspecified number of models. The air force supplies the school with one silhouette drawing of the plane and the school carries on from there. Using the official silhouette, enlarged plans are drawn by the boys on paper and, from these, metal templates are made for the various parts. As many as 500 parts are needed to make some of the detailed

(*Continued on page* 103)

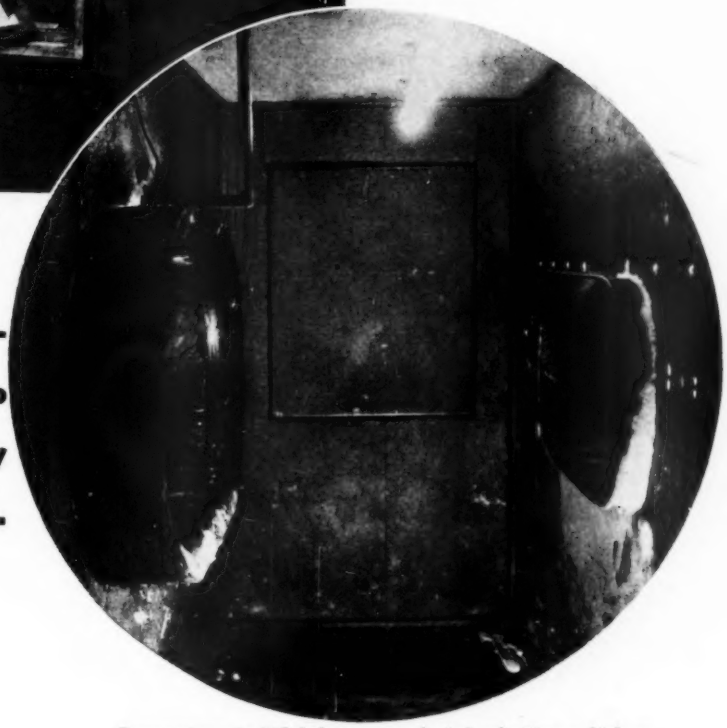
Scale replicas—some have 500 parts—of 28 Allied and Axis warplanes are built here.

ICE BOX

by HELEN WATERHOUSE

Goodrich wind tunnel data, gathered since 1930, has resulted in improved de-icers and windshield wipers.

Equipment developed and tested in this wind tunnel's sub-zero temperatures is a major safety factor in cold-weather flying.



Temperatures to 20° below zero and wind velocities as high as 80 m.p.h. can be produced in tunnel's interior (shown above).

A BOX-LIKE structure, 27 feet long, 12 feet high and eight feet wide, with frigid winds howling through its interior at a velocity up to 80 m.p.h., has become one of the most important aviation testing centers in the entire country. This is the B. F. Goodrich wind tunnel—one of two such tunnels in the world for testing at sub-zero temperatures. It is located at the company's Akron, O., plant.

Famed scientists and engineers come to peer through its windows at the storms raging within. Recently young Don Douglas, Jr., son of famed airplane manufacturer Donald Douglas, brought the carburetor of one of the big jobs now being built on the West Coast for Uncle Sam, to test within the structure, where temperatures down to 20° below zero can be produced and violent winds created within a few moments' time. Equipment is tested not only for army and navy planes, but for many other important aviation companies as well. The CAA sends materials for investigation, as do all major U. S. and Canadian airlines.

Engineers are constantly making changes and improvements on the de-icing equipment. Their work schedule is almost 24 hours a day. The equipment first was developed successfully in 1930, by Dr. William C. Geer, former head of the Goodrich research laboratories. He was working under a Guggenheim Foundation grant.

Today Akron-made de-icers tested in this tunnel are getting a workout over the Atlantic Ocean in one of the war's most dramatic aerial phases—the ferrying of fighting planes to Britain from Newfoundland's bleak shores. Most of the ships flown across are required to have de-icers. The newest type Goodrich de-icers are credited also with having kept RAF planes aloft in weather in which Nazi ships, lacking de-icer equipment, frequently have been grounded.

Airplane windshield wipers, tested in this same tunnel, sprang into prominence recently when the Civil Aeronautics Authority, after investigating the recent airline crash over Chicago, decided that ice on the windshield obscured the pilot's vision and was a contributing factor in the accident.

Pilots previously sprayed alcohol on the glass with hand pumps to get rid of the ice formation. A regulation type auto windshield wiper is not satisfactory on planes, because it is not powerful enough and may interfere with the workings of the radio and compass. This new wiper, recently developed by a Cleveland, O.,

How de-icer fits wing's leading edge. Engine exhaust forces air through tubes, pulsating rubber covering and thus shattering ice. Device was developed by Dr. W. C. Geer.

company, now is being placed on all this particular line's ships. Its blade is driven by a hydraulic motor. It moves very rapidly and presses against the glass, but affects neither radio nor compass. Engineers say it is the first really adequate wiper ever developed for planes.

Another important aid to air safety which recently came from the Goodrich wind tunnel's frigid interior is a "feed shoe" development for propellers. It conducts anti-freeze solution directly along the prop blades' leading edge, where the ice forms the quickest. Previous to this development, contrifugal force tended to pull the solution back from the blades' leading edge to less important parts. Trans Canada Airlines, which often operates through frigid temperatures, recently reported it could not have operated its new line last winter without these new propeller blade feeder shoes.

Wright Field at present is testing the shoes for possible use on all Uncle Sam's fighting planes.

"Military planes need better ice protection than commercial ships, even," explains Willson Hunter, aeronautical research engineer at the B. F. Goodrich Co., who is in charge of all wind tunnel tests. "They must complete flights without dodging ice storms. Frequently they must attack under icing conditions. The enemy is not going to supply them with nice weather reports. Often they choose to fly in icy weather and snowstorms in order to be less easily detected."

Goodrich engineers' practice of inviting anyone with new ideas on de-icing equipment to bring their devices to the wind tunnel for testing has resulted in many improvements in the entire de-icing picture during the past few years. Dr. Geer's original experiments culminated in the most familiar equipment for removing ice from planes—a rubber gadget with pulsating tubes for cracking ice from the wings' leading edges. The first practical test of this ice-removing overshoe was made in March, 1930, on a National Air Transport, Inc., plane. It indicated clearly the practicability of the pneumatic rubber overshoe.

The unique refrigerated wind tunnel was devised and completed in August, 1930, when engineers decided it was impracticable continually to search out ice-forming clouds.

A four-bladed propeller was built in the wind tunnel to test the various methods of de-icing. The first blade had a partial rubber covering, with a varnished surface on the rubber. The varnish was made of a composition not affected by water. The second blade was simply varnished. The third was covered with oil and rubber. The fourth was left normal for a control comparison. The rubber and oil combination was found to be far superior and was adopted.

Note propeller's anti-freeze feed shoe, developed through "ice box" experiments.

Through the years, various types of de-icers to protect every part of a plane which is subject to icing conditions have been successfully developed in Akron. Dr. Geer declares that not only the prevention of hundreds of airplane accidents and the savings of innumerable lives have resulted, but also, and more important, pilots have lost their fear of ice. In dozens of cases, de-icer boots have been able to bring planes through severe storms.

"Once he has experienced the safety of de-icers, the pilot is able to fly with greater assurance and give his attention wholeheartedly to the piloting job," he says.

Hunter, the Goodrich de-icer man, has been appointed a member of the recently formed national committee to study de-icer problems.

END

Expand Airport Program

MORE than 60,000 workmen are speeding construction on the expanded airport development program of the Work Projects Administration, which includes projects at 350 sites certified by the Secretaries of War and Navy as important to national defense. The development work at the 350 defense sites will cost about $150,000,000 and increase to almost 400 the number of landing fields and airports being improved by the WPA during the current fiscal year.

WPA workmen currently are engaged on 248 certified defense airport sites, with projects at 88 additional sites already approved and ready for operation. Work recently has been completed on eight airport developments. Every aspect of airport facilities—from grading of landing fields and paving of runways to construction of buildings and the installation of utilities and field lights—is included. WPA employees' work weeks have been increased to 48 hours where necessary for early project completion.

The program calls for expenditures, in WPA and sponsors' funds, of $13,681,000 in Florida, $11,834,000 in California, $8,929,000 in Maine, $7,981,000 in Pennsylvania, $7,138,000 in Washington State, $6,791,000 in Illinois, $4,922,000 in the District of Columbia, $4,618,000 in Alabama, $4,138,000 in Colorado, $4,117,000 in New York, $4,039,000 in Texas and $4,004,000 in New Jersey.

The largest allocations of WPA funds in the current program, by sites, include: Scott Field (Army), Belleville, Ill., $3,147,000; Philadelphia Municipal Airport, $2,212,000; Lowry Field (Army), Denver, $2,116,000; Snohomish County Airport, Wash., $2,084,000; Des Moines City Airport, $1,656,000; Baltimore Municipal Airport, $1,542,000; Stout Field (National Guard), Indianapolis, $1,212,000; McDill Field (Army), Tampa, Fla., $1,159,000; St. Paul Municipal Airport, $1,115,000; Naval Air Station, Jacksonville, Fla., $1,105,000; Ohio County Airport, Wheeling, W. Va., $1,083,000; City Airport, Albany, Ga., $1,079,000; Caribou Municipal Airport, Me., $1,022,000.

I LEARNED ABOUT FLYING FROM THAT!

No. 28

by Ens. J. C. Bower, Jr.

Ensign Bower.

The author flew a Grumman F4F-3 in this incident.

This pilot learned three lessons when he forgot to lower his fighter's propeller pitch and came down into Guantanamo Bay.

A NAVAL aviator learns a lot about flying. He learns what it's like to be glued to the back of the seat during a catapult shot. He learns how it feels to come to a sudden, stretchy stop in the arresting gear on a carrier deck. He learns how to make a downwind beach approach in a seaplane that just *will* weathercock.

He learns what happens when a target rushes headlong at him in a dive bombing attack. As his questing left hand gropes its way from trim tabs to bomb release, and pulls—the mixture control, by mistake—he learns the bomb won't go. And of course the engine won't go, either. He learns that, too.

In fact, if he's a passably smart Naval aviator, he learns that he'd better never stop learning! The first 1000 hours are the toughest, say the wiseacres. And as I round out my eighth hundred, I'm inclined to think they're right.

For me the most recent proof of this fact occurred on a hot February Friday at Guantanamo Bay, Cuba, where the U. S. Navy has long maintained an important base.

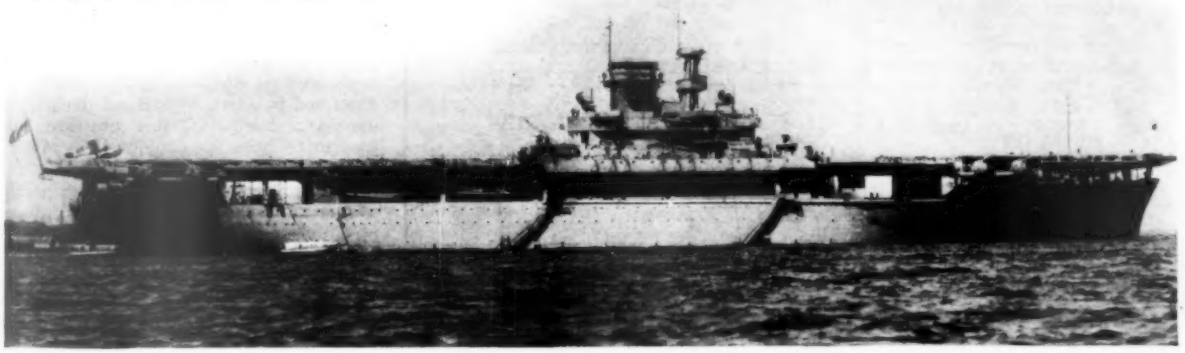
It was 10 minutes before seven, on a clear Cuban morning. As I sat in the cockpit warming up the 1,250 h.p. engine of my Grumman F4F-3 monoplane fighter I noticed that the wind was light and easterly. The tower duty officer had the tee set on a one-ball course. That meant my take-off would be on one of the shorter runways of McCalla Field, and directly toward some very rugged hills rising a couple of hundred feet above the level of the field. At that time I had not yet used this runway for a take-off, and I made a mental note to go into a left turn right off the end of the runway. This would head the plane toward lower and less formidable obstructions.

I turned my attention back to the cockpit. Cylinder head temperature, 150; oil pressure, 90; oil temperature, 75; fuel pressure, 15. All set to check the magnetoes. Turning up my constant speed propeller to 2,000 r.p.m., I flipped the propeller switch from "automatic" to "manual" and tested each magneto. It was my habit to check the magnetos with

(*Continued on page* 62)

U. S. NAVY

Fighting Squadron 72, Bower's unit, is based on aircraft carrier U.S.S. "Wasp," below.



CROSS SECTIONS

by B. R. OWEN

Use of the cutting plane process, described here by an outstanding aeronautical engineer, simplifies the work of designing streamlined fuselages.

A PROBLEM that confronts the designer very often is that of finding the cross sections of any shaped fuselage at any point. Finding the sections is very simple, but is not known to many model designers. This article is intended to clarify these difficulties and make more enjoyable the task of designing fuselages. Also, this solution provides the model builder with the necessary information to have streamlined fuselages which are very different from the usual elliptical sectioned type. Not only can any one section be of a certain desired shape, but any number of sections along the fuselage may be different from the others. That is, the sections may change in shape throughout the length of the fuselage. The procedure shown on the drawing illustrates this design possibility

This process may be used in any number of ways: for irregular cowl shapes, pants, odd-shaped bulges on the fuselage, fillets, nacelles, struts, wheels, etc.

Whenever cross sections are desired of airplane parts, automobile bodies, boat hulls, trains, or even mountains, these sections may be found by a simple procedure using cutting planes to locate individual points on the curve of the section. When several of these points are found, merely flow the curves from point to point free hand and then complete them neatly with a French curve.

Not only is it possible to design a model fuselage having any desired change of section but, even more important to some builders, is the fact that with a minimum of two or three cross sections (as furnished in three-view layouts of man-carrying airplanes) it is possible to make flying scale models with formers and bulkheads at any desired point. This should be cheery news to those who have wished many times that sufficient data had been given on a certain three-view to facilitate construction of a flying model. You see, there *was* enough data given. Without knowledge of the cutting plane process, however, this possibility was not realized.

Now, since we have found *what* we can do with the procedure, we wish to know *how* this result may be accomplished. To show clearly just what a cutting plane is, analyze the perspective shown at the top of the drawing. This sketch shows a fuselage cut through by horizontal flat plates. When looking at the side view of the fuselage you can easily see that these cutting planes would show as straight lines. This visualization prepares us to begin the drawing.

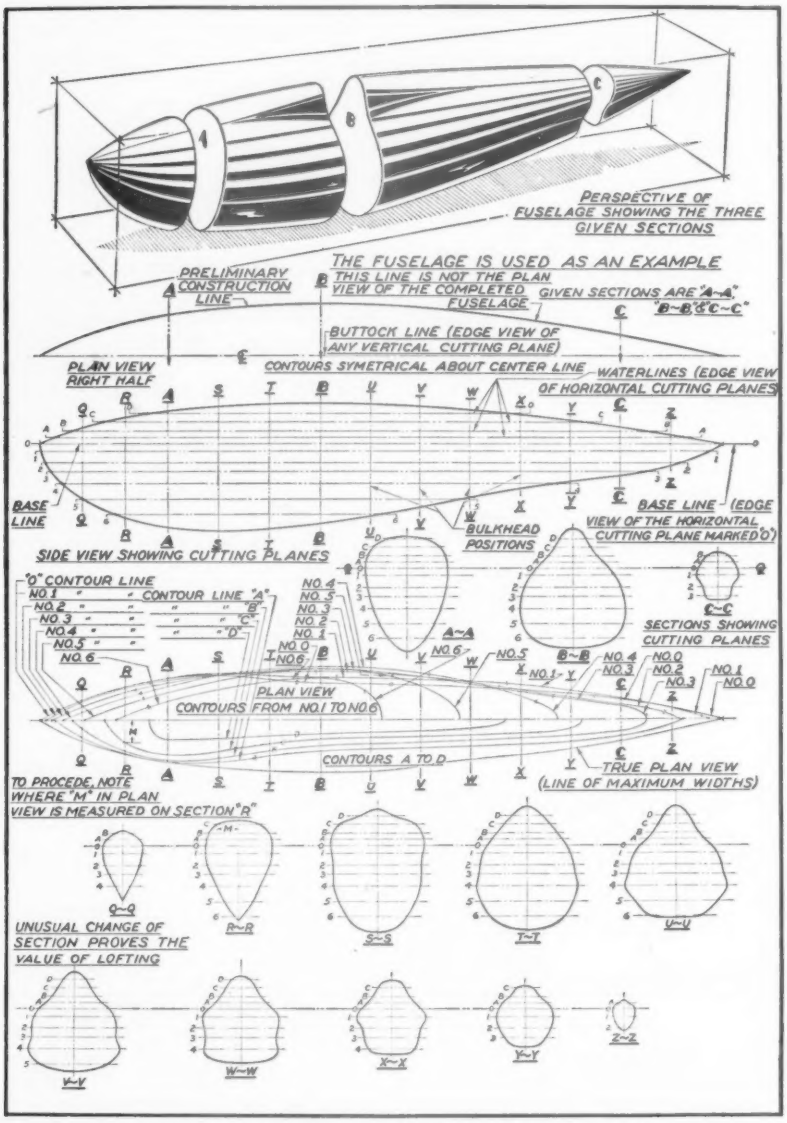
(1) Draw several horizontal lines parallel to the fuselage reference or center line in the side view. The number to be drawn depends on the degree of accuracy desired and the amount of available drawing space (avoiding confusion) in the top view of the fuselage.

(2) At some convenient place on the drawing conceive the desired cross sections (in the case of an original design), using only the height, width and center line. In the case of a flying scale job use the cross sections given even though they may be as few as two or three.

(3) Measuring with dividers from the center line in the side view up or down to each cutting plane (horizontal line), take this dimension and locate it as a point on the vertical center line of the cross sections which have been drawn as described in (2). At each of the points extend a horizontal line outward far enough to cross the contour lines of the given sections.

(4) Locating these points of intersection of the cutting planes with the contour of the cross sections, it is only necessary to flow in fuselage contour lines in the top view of the fuselage between each corresponding point on the given sections. This contour line locates the points

(*Continued on page* 101)


PERSPECTIVE OF FUSELAGE SHOWING THE THREE GIVEN SECTIONS
THE FUSELAGE IS USED AS AN EXAMPLE
PRELIMINARY CONSTRUCTION LINE
THIS LINE IS NOT THE PLAN VIEW OF THE COMPLETED FUSELAGE
GIVEN SECTIONS ARE "A-A" "B-B" "C-C"
BUTTOCK LINE (EDGE VIEW OF ANY VERTICAL CUTTING PLANE)
PLAN VIEW RIGHT HALF
CONTOURS SYMETRICAL ABOUT CENTER LINE
WATERLINES (EDGE VIEW OF HORIZONTAL CUTTING PLANES)
BASE LINE
BASE LINE (EDGE VIEW OF THE HORIZONTAL CUTTING PLANE MARKED "0")
SIDE VIEW SHOWING CUTTING PLANES
BULKHEAD POSITIONS
"0" CONTOUR LINE
NO.1 " " CONTOUR LINE "A"
NO.2 " " " "B"
NO.3 " " " "C"
NO.4 " " " "D"
NO.5 " " "
NO.6
SECTIONS SHOWING CUTTING PLANES
PLAN VIEW
CONTOURS FROM NO.1 TO NO.6
CONTOURS A TO D
TRUE PLAN VIEW (LINE OF MAXIMUM WIDTHS)
TO PROCEDE, NOTE WHERE "M" IN PLAN VIEW IS MEASURED ON SECTION "R"
UNUSUAL CHANGE OF SECTION PROVES THE VALUE OF LOFTING
Q-Q
R-R
S-S
T-T
U-U
V-V
W-W
X-X
Y-Y
Z-Z

Sections cut through fuselage at points shown above establish smooth contours.

BLIMPS FOR UNCLE SAM

by N. E. Stell

Europe's war has proved barrage balloons a deadly defense device. Now Akron is making them for Uncle Sam.

Goodyear workers inspect new blimp's fabric. Balloons are brownish, 110 feet long and 40 feet high.

Final factory inspection. Bags are to be flown at altitudes from 500 to 18,000 feet. Helium capacity, varying with each, ranges from 1,470 to 75,000 cubic feet.

LIKE a row of chunky pigs America's first half-dozen barrage balloons are soon to be dotted across the horizon line of Akron, O., a city which is now becoming the center of the barrage balloon building industry of the country. Warnings have already been issued in printed form to traffic control stations at airports all along the line, for pilots flying in the barraged area to double precautions and to regulate the altitudes at which they fly accordingly.

Described as six "high and low altitude balloons," the bags are inflated with helium and are flown simultaneously at various altitudes, the warning states. Hundreds of skilled workers at two of Akron's major rubber companies are working on construction of the six balloons and of many others which will follow them into the air.

Both girls and men are busily engaged in taping the seams, affixing the fins, and inspecting every inch of the fabric in this business of production of the newest type of air defenses. Besides Goodyear and Firestone, which already are in production, the General Tire and Rubber Co. soon is to start building the barrage balloons and the B. F. Goodrich Co. already is making cloth for more bags.

Activity on the new type of air raid defenses followed an announcement recently in Washington that the Government has formed several balloon barrage squadrons which will be used to handle the new balloons. The barrage balloon activity in the army was spurred by reports of Brig. Gen. George V. Strong, former chief of the War Plans Division, who recently returned to this country after making first-hand surveys of British air defenses.

Strong reported that London barrage balloons were keeping the Nazi bombers at high altitudes and had made the diving tactics of the dreaded *Stukas* a "suicide menace." Germany and Italy have adopted similar defenses because of England's success with them, he said.

Following the general's report, rubber company officials from Akron were immediately called into consultation with Government experts to see what could be done in the way of constructing the balloons. The Army had been testing barrage balloons on a limited scale for the past 10 years, but never had seriously considered adopting them before. Last year the Goodyear company, foreseeing their importance in the defense picture, constructed the first bag and flew it in tests at Wingfoot Lake, the lighter-than-air station on the outskirts of Akron.

This first bag made headlines when it broke loose from its cables one day last spring after it had been sent aloft to 75,000 feet, and travelled 200 miles before landing at Kittanning, Pa. It was recovered and returned to Akron for repairs.

The new bags are clumsy looking affairs made of brownish cloth, with huge fins for stabilizing purposes. They are 110 feet long, with a 40-foot overall height and are flown on 7/32-inch steel cables. The bags are to be flown to altitudes ranging as high as 18,000 feet.

The first balloon in the barrage of 1,470-cubic foot capacity will be elevated

to a distance of only 500 feet and, next to it, the second balloon of 2,000-cubic foot capacity will fly at 1,500 or 2,000 feet. The third balloon of 2,000-cubic foot capacity will fly at 2,500 feet, the fourth balloon of 5,000-cubic foot capacity at 4,000 feet, the fifth balloon of 25,000-cubic foot capacity at 7,000 feet and the sixth balloon, of 75,000-cubic foot capacity, will fly between 5,000 and 8,000 feet.

Adding color to the picture are the red and orange wind cones attached to the steel cables at 200-foot intervals and the pennants fluttering between the cones.

Tests on the balloons are made only during daylight hours and will extend over a six-month period, engineers and lighter-than-air experts say. Two major airlines of the country are affected by the warnings of the barrage being erected at Wingfoot Lake—both Pennsylvania Central and Transcontinental and Western Air liners fly directly across that area on regular schedules.

Akron is no novice at the balloon building art and Wingfoot Lake is an old locale for the flying of wartime balloons. The Goodyear company built hundreds of "kite" balloons during the World War and flew them at the lake station. In those days the balloon room at Goodyear became one of its busiest departments, employing 2,800 men and women towards the end of the war and turning out four balloons a day. All told, Goodyear built more than 900 observation balloons at that time.

Firestone Tire and Rubber Co. also turned its entire new Plant No. 2 over to the production of kite balloons during World War days and continued production of them until the end of the war.

END

Mountains Conquered

PENNSYLVANIA'S Allegheny Mountains no longer comprise an aviation death trap. The state's non-carrier pilot accidents dropped from .119 per cent in 1938 to .069 per cent in 1939, following a four-year airport construction campaign to cut the steadily mounting toll.

Instrument flying brought commercial carriers safely through unfavorable weather. Their ships had range to search out airports. Non-carrier pilots, however, often were forced to make crash landings when faced with bad weather or mechanical failure during flight. As a result of the WPA airports and airways program, enough airports have been built to overcome weather hazards developing during flight and to allow safe landings despite engine difficulties in most cases. Twenty-seven airports were constructed, repaired, or added to under the program during the four-year period. In addition, numerous airway markers were erected, fields lighted and radio facilities improved.

Non-carrier aircraft activity increased proportionately. From 1936 to 1940 the number of such ships in Pennsylvania rose from 479 to 785, while licensed pilots increased from 806 to 1,484. Accidents zoomed from 93 in 1936 to 130 in 1938, then dropped to 124 in 1939 despite the increase in flyers.

Airline Block Signal

AN "automatic block signal" system for airlines has been perfected by TWA radio engineers to replace manual flight control board (above) now in use. New device moves small brass block (closeup at left, marked "FLT 38"), representing plane in flight, over electrically-driven worm. Speed—regulated by timer—is based on ship's ground speed, with allowances for weather conditions and load.

Self-Sealing Gas Tanks

SELF-SEALING gas tanks are standard in these Douglas attack-bombers. Exterior of tank is a fireproof fabric, interior a material impervious to gasoline. Between is a layer of a special rubber composition which swells greatly on contact with gasoline, thus immediately sealing any hole and effectively preventing leakage. These improved tanks are being installed in wing sections as ships move down assembly line. U. S. Army and Navy and British RAF planes feature them.

PUSHERS FOR TOMORROW

by ROBERT L. BROWN

Though speedy, pusher planes' lack of stability slowed their practical development. Now new design trends again are bringing them to the fore.

FOR some time it has been known that the superlative in airplane performance lay in the pusher airplane. This design was embodied usually in the low-speed types of ships.

If the pusher design is fastest, why has it not been used more in pursuit planes? The answer lies in the fact that the usual design showed unfavorable stability characteristics at high speeds. Therefore, the pusher was laid aside during consideration of suitable designs for pursuit planes.

To facilitate complete understanding of the problem, it is advisable to give a simple illustration of the relations and reactions involved. Let us consider a stick being pushed through water. As velocity is increased and direction changed, the forward end of the stick tends to whip back, reversing its position to the rear instead of retaining the lead. We know that a stick may be pulled by its forward end at maximum velocity without any trailing-end swing, or loss of stability. Stability actually increases until the stick may be called "in the groove" for it is directed by the airflow to such a degree that it is almost impossible to change its angle incident to the air stream.

We know that motivation at the extreme trailing point of the airplane is very unstable directionally and laterally. Also, we know that thrust at the leading point of the airplane will reduce the high-velocity directional problem to a minimum. However, it is better to place the propeller in such a position that it doesn't have to pull against the wing and fuselage as in the case of the tractor. Furthermore, the air flows smoothly over the fuselage; it does not pass through the screwing angular propeller blast, which is detrimental to high speed. No speed correction factors, relative to angular airflow, are necessary when considering the fuselage and wing.

The pusher propeller utilizes a higher percentage of the engine power in actual forward progress. A pusher with a given horsepower will fly faster than a tractor of the same power, which must pull against the wing and fuselage. If we can eliminate the disadvantages by using a pusher, the problem of directional control in the horizontal and vertical planes at high speeds seems possible of solution.

A relation may be made between the speed and the motivation-moment arm relationship. If we reconsider the stick we may easily see this simple relationship. Consider the forward end of the stick the center of area of the wing. Also, consider the trailing end as the center of the stabilizer area. Now if we consider a movable point "A" on the stick (Figure 1) as the point of motivation, or propeller, we can see that stability is increasing as A moves toward x, bearing in mind that when the point has reached the forward end, the point at which maximum motivating power can be applied without loss of stability has been reached.

As the motivating point progresses from the zero point (the trailing end), stability becomes greater. We may see now that if the propeller is placed near the center of wing area and a relatively long distance from the empennage, stability will result. However, to attain that stability a new design will have to be made in the modern pusher.

At this point the writer feels that this new idea should be analyzed from a mathematical standpoint. Let:

A = Center of motivation or point of thrust (is free to move from y to x)
x = Center of area of main lifting plane.
y = Center of area of empennage.

As A moves from y to x directional and lateral stability increase from minimum to maximum. If object xy is pushed from point y forward, its position upon displacement in angle will be interchanged with point x, thus reversing their order. This displacement would prove disastrous in an airplane design. The fuselage structure would collapse if such an abrupt change took place.

Application of a design with a relatively high directional constant (explained below) should result in a high speed exceeding any thus far achieved (with a given horsepower). The ultimate solution occurred to the writer in the form of an extension - shafted motor. Since the propeller is usually placed as near to the center of lift as possible the main change will be in the length of the empennage moment arm. By placing the engine in the nose and using extension shafts to the propeller, the weight is moved forward to such an extent that a long lateral moment arm may be used without the result of a stalling condition. An example, in the form of a two-view layout of the design principles embodied in this article, is shown in Figure 4.

The best way to compare relationships is to construct a series of possible designs and, regarding sensible proportion and streamlining, use the one which has the largest directional constant. This constant may be found by dividing distance xy by distance xA. In form it appears as:

$$\frac{xy}{xA}$$

The plane shown is not of practical design, but serves merely to illustrate the relation of certain distances. The propeller blast would tear away the trailing edge of the wing; the wing's low aspect ratio would use up too much power and

FIG. 1

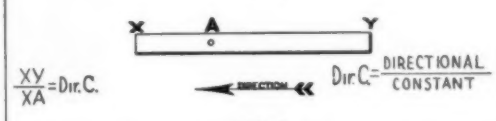


FIG. 2

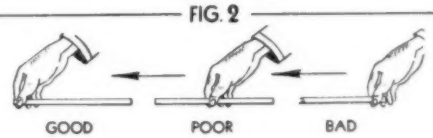
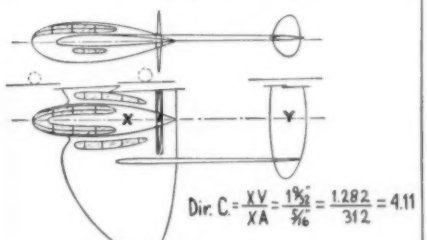


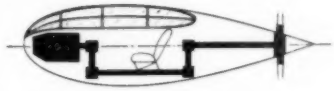
FIG. 3

DESTRUCTION RESULTS IF COMPRESSING MEDIUM IS SUFFICIENTLY DENSE

FIG. 4



BY CAREFUL CONSIDERATION OF DESIGN FACTORS ONE CAN INCREASE THE DIRECTIONAL CONSTANT



Problems of streamlining yield easily to the pusher. Shown above are four examples of airflow experiments.

the canopy design would cause distorted vision. The glass would be too thick for satisfactory observation. The criticism of this design was included for general information.

One admirable solution to the pusher problem is evidenced in the English General Aircraft "Cygnet." This design seeks improved stability by using a high directional factor. The propeller is placed almost even with the center of lift of the wing; the front part of the passenger nacelle is located in conventional position just ahead of the propeller. This design gives a very odd side view, but attains the desired good stability which pushers must have.

One of the newest German pursuits, the Focke-Wulf Fw-198, is a pusher design. It is not as stable as the "Cygnet," but points to the improved American pusher pursuits which undoubtedly will appear in the near future.

It is true that the extension-shafted engine would prove most satisfactory to the stable pusher. However, great difficulties are encountered in dealing with extension shafts. Designers of the Bell *Airacobra* and *Airabonita* have encountered difficulties in the use of the extension shaft. Shaft whip, vibration, weight and other factors complicate the design. If these problems can be solved satisfactorily, the design shown at the bottom of the illustration should result in an extremely stable pusher. When the extension shaft's problems are conquered it is unbeatable for streamlined design and maneuverability.

Each end of the extension shaft has a flange providing a mount for a flexible-splined coupling at the front to drive the extension shaft to the propeller shaft reduction gear box. This provides a mount at the rear for a dynamic torsional vibration balancer. Splined to the hub of a dynamic balancer is the outer member of a hydraulic damper. An inner member is connected to the outer rigid member by a composite flexible-quill shaft and reacts against the outer member through a hydraulic medium to minimize single node low-frequency torsional vibration.

In the case of the Bell pursuits, the propeller shaft reduction gear box and propeller mount are connected to the engine by an extension shaft composed of two flanged shafts, each 2.5 inches in diameter, 48 inches long and supported at the center by a self-aligning ball bearing mount. The reduction gear consists of two aluminum alloy castings which support the propeller shaft, thrust bearing, reduction gear and pinion gear. The reduction gear is an external spur gear bolted to a flange of the propeller shaft. The propeller shaft is supported at the front by the thrust bearing and at the rear by a large roller bearing. The pinion gear is mounted between two roller bearings and is driven by the extension shaft through an internally splined flexible coupling. Reduction gear teeth are lubricated by an oil nozzle supplying three jets of oil directly on the teeth. Drive for the overhead camshafts is provided by a gear train which starts at the

(*Continued on page* 105)

Bomber Laid Up

NEW problems were created by the weight (83,253 pounds, empty) of the monster Douglas B-19, world's largest bomber, during preliminary taxiing tests. The ship proved too heavy for Clover Field's macadam runways, breaking through the surface when it was taxied out. Added complications followed braking. While the ship stopped satisfactorily, the pressure on the brake bands sent clouds of smoke streaming from one wheel. Thinking it was ablaze, a fireman hastily turned a carbon dioxide extinguisher on the 96-inch giant. The sudden change in temperature cracked the huge casting. Since the landing gear's components are custom built, this forced further tests' postponement until new parts can be manufactured.

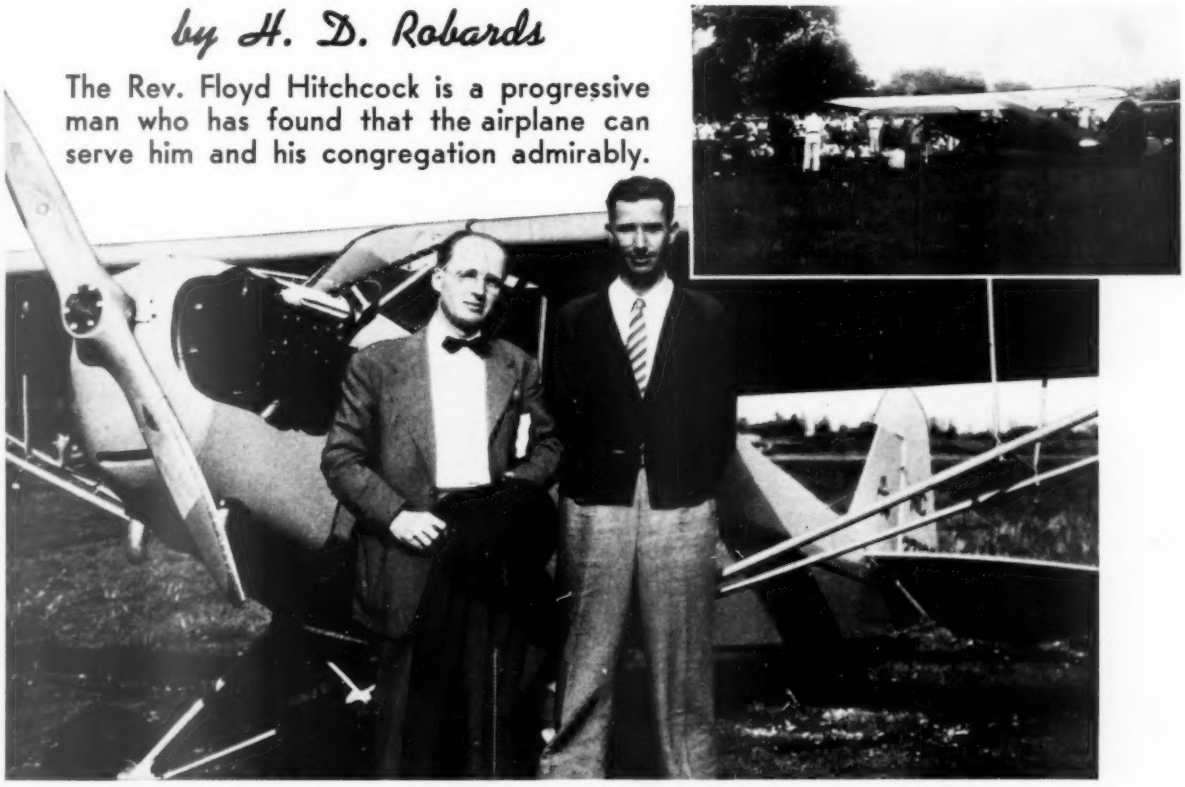
Engine Testers

THIS electric generator, one of 16 such 1,250-kilowatt units just completed at the Westinghouse Electric and Manufacturing Company's East Pittsburgh works, was built for airplane engine factory use in "breaking in" aircraft power plants. The generators first will run as motors to crank the engines, then as generators to limber them up during test runs. They "load" the engines, having the same effect as propellers do in planes. At the same time, and incidental to their main purpose, they supply electric energy for use in the factory. Each generator can produce 1,250 kilowatts, enough to light 12,500 hundred-watt lamps.

The Good Ship Emmanuel

by H. D. Robards

The Rev. Floyd Hitchcock is a progressive man who has found that the airplane can serve him and his congregation admirably.



Reverend Hitchcock (left) and Burley Helvey, an aide, fly "The Good Ship Emmanuel" constantly to church meetings, radio broadcasts and outdoor religious services like that shown in the inset.

SEVERAL years ago the Rev. Floyd Hitchcock returned from six years' missionary work in the Orient, settled on a country place about half a mile from the Springfield, Mo., municipal airport and instituted a daily religious service over station KWTO in Springfield.

It was a non-denominational, non-sectarian service at 5:15 every morning; studies and other work kept him busy all day. Soon, calls came for the radio preacher to visit many congregations in Missouri, Kansas, Oklahoma and Arkansas. That distance was long on the ground; the minister became frantically busy. Sundays were especially trying. He'd hold the radio service, then speed away as far as 150 miles, fighting Sunday traffic at high speed regardless of personal danger.

Meanwhile, airplanes droning overhead continually added to the physical discomfort of the minister at his daily studies. Gradually that disturbing drone began to mean something else to him. It suggested transportation high and free from worry, easy and safe, with relief from that wearing tension of high-speed highway travel on Sundays.

Reverend Hitchcock's missionary training was to turn all things to religious work. He inquired about the cost of planes at the local airport. Any dream of flying was conditioned by thought of finance—a minister is first to realize the truth behind the story of the church member who told his pastor, "Sure, I know I owe the Lord, but He ain't pushin' me like some of these others."

To try it out, the minister chartered a lightplane and a pilot from the Springfield Flying Service for four Sunday trips, testing out his idea that flying would greatly enlarge his own physical capacity for Sunday meetings—and save time too. Those trips averaged 80 land miles and followed the pattern of trips in the plane he subsequently purchased, except that the pilot was the only one who accompanied him.

Those four charter trips proved that flying offered him both physical and financial economy. He checked gasoline and oil consumption and found it to be less per mile than for his light car, a saving of approximately a third.

He filled engagements at 11 in the morning which would formerly have been filled at 2:30 in the afternoon by a man tired out because of a long, hard trip by car. He sold himself on flying.

Next step was to sell his congregation. It must be said that his congregation offered a particularly good testing-ground for flying in religious service. The area includes industrial sections and the Ozark Mountains, known as the last stronghold of pure-strain descendants of original Anglo-Saxon settlers—such an area should include a fully normal proportion of those who are chronically against anything new.

But neither owners of hill farms nor professional men of the cities insisted angrily that a plane in church must be an idea from Satan. All contributed to the down-payment fund. Public announcements of the intention to buy a plane were made in April, 1940, over the radio and through The Gospel Messenger, a monthly magazine published by the minister. The initial payment of $611 to apply on a Piper *Cub Cruiser* priced at $1,833 was raised, the plane ordered and delivery secured in July. Its maiden voyage in church service was made on July 28, 1940. After that voyage, a dedication ceremony was held at its home port, the ship being christened *The Good Ship Emmanuel*, its name meaning "God With Us." There might be subject matter for a tract in relating that name to the fact that the widely-spread congregation is contributing steadily to the plane fund and the $108.20 monthly payments. But the congregation was merely informed about the cost, safety and time-saving possible. They did the rest.

Since July 28, 1940, the plane has been used regularly on Sundays and has averaged about one trip a week otherwise. There is no established route; Reverend Hitchcock goes where he is asked to go. Here is a typical list of a few places visited: Carnes School near Siloam Springs, Ark., a union service; Mt. Pisgah Methodist Church, Monett, Mo.; Bible conference in high school gymnasium, Toronto, Kans.; Christian Church, Crocker, Mo.; Baptist Church, Kansas City, Kans.; Church of God, Avilla, Mo.; Sulphur Bend School near Fairland, Okla., a union service. The list grows steadily; longer trips are being made to Amarillo, Tex., and points in Oklahoma.

That listing should explain why large planes were not considered—for another reason that is not economy. When a call is received, the ministerial party tells the congregation to pick out a fairly smooth 40-acre field, mark it by pinning a bedsheet to the ground in its center and be ready on time for the service. The pilot will land on that bedsheet-marked field. Fully half the calls come from small town or country congregations which are far from airports; large planes could not have landed there.

Joe Fallin of the Springfield Flying Service was the first pilot, both on chartered trips and in *The Good Ship Emmanuel*. He is a Springfield man, has only recently received his commercial license and 2S rating. He refused to land on the field selected for them once, found another and landed. A car sent by the congregation arrived to pick them up within 10 minutes. It is generally possible to land just across the road from a country church or schoolhouse.

Reverend Hitchcock is no pilot—yet. He's learning, though. But he's busy and can rarely give more than two hours weekly learning to fly. One member of his church group beat him to becoming a pilot. He is Burley Helvey, who joined with his wife singing on the Sunday morning radio hour. Following World War I, Helvey purchased an old Jenny and used it for a time for his own pleasure. His active aviation interest had lagged, however, before *The Good Ship Emmanuel* was purchased. Then he took up training under the Springfield Flying Service. He recently passed his solo examination and, by the time this is printed, will have logged enough solo time to get a private license. Then he will pilot the ship and serve as a singer too. Mrs. Helvey will accompany the party at times. Reverend Hitchcock's family, from the baby daughter of four, up to Mrs. Hitchcock, are enthusiastically accumulating flying experience as opportunity permits.

The Sunday routine begins with the morning radio service from 7 to 7:45. From there to the airport to study air maps, winds and weather with the pilot and take off in time to reach the destination from 75 to 250 miles away between 10:30 and 11 o'clock. Flights are generally to the town, thence to the selected landing field, following directions obtained by correspondence. So far, there's never

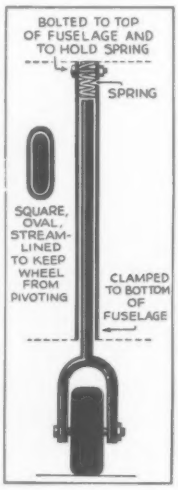
(*Continued on page 82*)

Simplifies Rigging Planes

ANGLE measurement when rigging planes is easy with this handy gadget devised by a mechanic at Central Air Service, Grand Rapids, Mich. The instrument consists of an aluminum plate about ¼" thick and 8 x 10" square. A round hole is cut in this plate's center and the upper edge recessed about ⅛". An aluminum disc is tooled to fit the hole snugly and flanged to match the recessed edge. A line is scored across the exact center of plate and disc. Parallel to it a slot is cut and a small spirit level glass and holder attached. The plate is scored with 360° calibrations around the disc. Springs hold the disc in place.

In use, the plate's upper edge is placed against the object to be measured and the disc turned with a knob until the level's bubble is centered exactly. The line shows the angle at a glance.

Glider Landing Device


BOLTED TO TOP OF FUSELAGE AND TO HOLD SPRING
SPRING
SQUARE, OVAL, STREAMLINED TO KEEP WHEEL FROM PIVOTING
CLAMPED TO BOTTOM OF FUSELAGE

A GLIDER landing gear which is left on the ground when the ship soars into the air has been designed by Sterling Hostetler, La Grange, Ind., in order to cut weight and drag. It consists of two struts, one fitting within the other, as shown in the diagram. The larger is mounted inside the fuselage, while the wheel is attached to the second. Both are squared oval in shape, to prevent the wheel from pivoting. They should be as long as possible, so that the chassis will not leave the fuselage until the ship is at least three feet off the ground.

The wheel should be placed ahead of the strut, so it will fall backwards and not catch in the ground. Of course, the two struts must fit perfectly to insure smooth operation. The spring, while not essential, saves the landing gear from fatigue.

A skid is provided for landing. Most gliders are so equipped already to reduce landing run. Further, a skid will eliminate wingtip damage and make the ship stay put when it contacts the ground.

Utilization of this device, its designer reports, makes possible 100-pound gliders with remarkable performance ability, since it eliminates both weight and drag of landing gear, whereas attempts to equip gliders with retractable gear have proved impractical due to the retracting mechanism's weight.

AIRCRAFT OWNERS AND PILOTS ASSOCIATION

AOPA NEWS

*The Aircraft Owners and Pilots Association, with Service Headquarters in the Transportation Building, Chicago, Ill., is a non-profit organization formed and composed of non-scheduled aircraft pilots and/or owners exclusively. The AOPA operates with a full-time professional staff and is the largest group of civilian pilots in the world. This column is devoted to news of importance to AOPA members and is of a non-confidential nature.**

ONE of the most important projects ever undertaken by the AOPA now is in the formative stage. The Air Guard, a subsidiary of the AOPA organized to permit private pilots to help the Government, is on the way. Plans are being formulated to create a separate kind of civilian air corps which might prove a boon to the Army.

The Air Guard is not a very formidable project from the pilots' angle. It is just an opportunity for AOPA members to do something for their country, rather than merely to get something from it. Military pilots cannot be trained as fast as infantry, nor can they be selected from civil life as fast as the need for them multiplies. We believe that, should war come, there will be a bottleneck in pilots who are able to absorb the intensive training an Air Corps pilot must have.

These flying cadets must be men within certain age limits, of excellent education, superb physique and enough other "musts" to narrow the field down to the cream of American youth. That leaves tens of thousands of Americans who can fly, who want to help, but who have no military aviation training. The Air Guard is designed to fill that gap. Every American who can fly *now* can fit himself to help if his help is needed.

The plan is a sort of civilian counterpart of the Air Corps, with members being given short courses of study in subjects which have a military value. Coupled with these courses are extended forms of practice flying which teach the pilots something about the work they might be called upon to do if the War Department assigns auxiliary services to the organization. No member of the Air Guard is required to join either of the armed services or commit himself to compulsory training. Special insignia is to be provided and ratings are issued. Graduates of the course will find themselves prepared to do their part in the air.

There is a separate fee for membership in this organization, tentatively placed at $5. This will cover the cost of instruction manuals supplied to members and provide for an examination system. Details may be obtained by writing to the National Service Office, Chicago.

OPM Dooms Lightplanes

News from Washington says that manufacturers of lightplanes and engines for them have been summoned to Washington by the Aeronautical Chamber of Commerce for a final show-down on the reported ban on lightplane production during the present emergency.

It is reported that manufacture of new lightplanes will cease. At present, aluminum for this purpose is in A-10 priority division, meaning that it is difficult to obtain. The OPM said that there will be enough material released to continue manufacture of light trainers for the CPTP, but that sportsmen flyers would have to purchase planes which have been retired by the CPTP after 800 to 1,200 hours. Material to build any private aircraft will be released by the OPM on a "case-by-case basis" wherein cause must be shown why the new craft is necessary.

Meanwhile, both Army and Navy are trying to squeeze builders of training planes as far out of the all-metal construction policy as possible. Ryan's new trainer will have fabric wings; others will use some form of plastics for everything but fuselage and landing gear assemblies. The new schedule will allow only 195 pounds of aluminum, *gross*, for new CPTP trainers. That figure includes engine requirements. Neither the Army nor Navy will continue the use of all-metal airplanes for training.

Some authorities say that when present stocks of lightplanes now in dealers' hands are sold, there is scant prospect of any more until the country returns to normal.

Beware of Down-Wind Turns

Analysis of the down-wind stall indicates the insidious danger of this maneuver for the pilot, says AOPA writer Arthur Halsted. He might find himself in a mild gliding turn down-wind just after leaving true horizontal flight. He might not realize at first that his airplane is in a down-wind turn. Soon he begins to feel symptoms of a stall in the plane's controls. Airspeed drops alarmingly.

He is in a slight bank, with one or two degrees of yaw. Aerodynamically, this is a dangerous situation. That slight degree of yaw which accompanies a down-wind turn produces a new force. The pilot is getting some lift from his keel surfaces, or structural shape of the fuselage. In a flat calm or in a headwind he would not get this force. Because the wind is on his tail, the whole aerodynamical pattern of the ship is changed and the fuselage itself develops a lift.

This "keel-surface lift" tends to delay the turn. It provides just enough force so that there is a natural reluctance on the ship's part to change direction. Coupled with falling air-speed, which will be the first symptom of down-wind flying, a complete state of stall results.

The pilot's desire to get back to the field is very strong. He increases his bank by a small angle to give the ship more chance to turn. This destroys a little more vertical lift and increases this strange "keel-surface lift." He has provided the very conditions under which a true stall can occur.

He realizes he must get the nose down. Intending to nose down even more and thus pick up air-speed and at the same time get rid of that yaw, he pushes his rudder toward the inside of the turn. This would be perfectly safe and would

AOPA Greater New York Unit's executive organizing committee. Standing, l. to r.: Lawrence Galin, Charles Ripley, Hans Groenhoff, Jerry Ritchey and Charles Kiebles. Seated: Harold Grening, Robert Smith, Heber Sutton and Howard Hasbrook.

* The views and statements of opinion contained in this column are those of the Aircraft Owners and Pilots Association and not necessarily those of Flying and Popular Aviation. This column is edited by the staff of AOPA for its members and other interested parties. Special releases of a more confidential nature are additionally sent each month to all registered members.

accomplish his purpose—*if* he was not in a down-wind turn. But since he is, this is what happens—

Pushing the rudder increases the lift force from the "keel surfaces" or structural mass of the fuselage. It adds a strong side force from the rudder. This side force kicks the tail around in the turn, losing more speed constantly. By the time a 90° turn is accomplished and the ship has reached a cross-wind position, it will stall. All the controls will go mushy and the pilot's chances of getting back to the field safely are almost microscopic.

SOS from Florida

From Steve Albee, Jr., AOPA No. 464, the National Service Office is surprised to hear of another move by a state legislature to hike taxes on aviation gasoline to the point of hindering private flying seriously. The Florida legislature is trying to slap on a 7½-cent tax on each gallon of fuel sold. The Florida West Coast Aero Association is fighting this bill violently and calls on the National Office for help.

We therefore notify Steve Albee and all Florida AOPA members that the organization will do its utmost to aid them in their fight against this bill. And we thank them for bringing it to our attention.

Send Him a Money Order

From William H. McManus of Chicago we have received further word on the AutoFYRstop quick-action fire extinguisher which has been offered to AOPA Members at a drastic discount. "Please tell the members," says Mr. McManus, "that we appreciate the volume of AOPA orders for this equipment which have come in. But please tell them, too, that I can't afford to give this discount and pay for cashing checks, too. I have to pay 5c for clearing each check and 10c for cashing it. This is too, too dog-gone much. Therefore, no more C.O.D. orders for the AutoFYRstop extinguisher. Tell the boys to send a postoffice money order." Okay, Mr. McManus. That's that.

IN MEMORIAM

Dr. Grady W. Eason, No. 3949
Bryan Poston, No. 470
Elmer N. Johnson, No. 4538
Cleon O. Hanson, No. 461
Dan F. Leahy, No. 5237
Raymond Richards, No. 2784
Francis M. Shook, No. 1755

Dingwall's New House

William "Bill" Dingwall is a Booster Member who sees potential AOPA members whenever a private airplane crosses his horizon. Inspired by his enthusiasm, several AOPA Units throughout the east have passed the fledgling stage and have sprouted their wings and become big. This month Bill is looking for a new Unit which he himself can join. His business has transferred him to Wellesley Hills, Mass., and he's at home there at 19 Bradford Street, which sounds like a distinguished address indeed.

(*Continued on page* 101)

Want a Job?

by HURD BARRETT

THIS column is getting tougher to do every day. Manufacturing industry employment conditions are changing so rapidly that information may be obsolete by the time you get your copy of FLYING AND POPULAR AVIATION. And since we're not a superman, we can give you conditions only as they are now and probably will be a couple of months hence.

* * *

J. L., Danville, Ill., writes that he's had four years of high school mathematical and drawing training. On this basis, he should be able to get a job today with almost any manufacturer, in the lofting, template, engineering or tool design department. He wants to know whether or not he should go on and get further training at considerable financial sacrifice before he tries to get a job. We think not.

Education does not cease with employment. It begins. Get your job first, J. L., particularly since you've had valuable training already. Then, while you are working, find out what your shortcomings are and take whatever specialized courses you may need to overcome them . . . M.I.T., Carnegie Tech and California Tech are all top flight aeronautical engineering schools; but almost any of the State Universities can give you the same basic training. So can any first rate trade school. Boeing and Curtiss-Wright, for instance, give the type of training you ask about. But you'll know better what things you have to dig on if you are actually working.

Once you are at work, most employers will even hold your job open if you want to take time off for a course in some specialized subject. That's because you're more valuable to them as a specialist. It's easier to specialize after you're in a business than it is before you know anything about the practical problems it presents and you can learn more by doing a thing yourself than by having it explained to you.

* * *

We mentioned that there's been a change in what manufacturers demand in the men they hire. Whereas six months ago employers' emphasis was on securing employees with special skills and a person without a special skill didn't have an awfully good chance to get a job, the situation today is quite different. Lockheed, for instance, is hiring a great many men who have never had any specific aircraft or mechanical experience. They give prospective employees aptitude tests, to determine whether or not they can be trained readily to do a mechanical job. Some people, they've discovered, can be trained much more easily than others. Manufacturers now are interested in finding out whether a man can be taught to do a rather complex assembly job quickly and efficiently.

Of course this doesn't mean that if you are a competent machinist, tool-maker, or other specialized mechanic, they won't hire you. But in the absence of skilled men, they hire men who have the qualifications which make it easy to do a "production task." Today, the employer often will train you after you go to work for him, if he thinks that you will adapt yourself swiftly and easily to the work he expects you to do. Hence the sometimes apparently pointless mechanical aptitude and intelligence tests.

Those of you who want jobs in manufacturing in a hurry should apply to the nearest major manufacturer, stressing any qualifications you think you have for aircraft work. As a result of the current demand for labor many of you, who seven or eight months ago would not have stood a chance of employment, today will get jobs. The better your qualifications, of course, the better the job you'll get, but without qualifications, you will still stand a chance, provided your employer thinks you are adaptable.

* * *

In this connection, let's quote a few lines from an article prepared by Oscar Schuster of the Lockheed personnel training department. He's talking about pre-employment training. He says: ". . . Courses are set up (by the company) for those workers who have no skill in any phase of aircraft manufacture . . . It is given to qualified individuals in a short, concentrated training program to develop quickly sufficient skill to enable an individual to gain employment . . . Inexperienced but mechanically apt individuals are given training . . ."

Incidentally, most manufacturers give a training program for recognized engineering universities' recent graduates. Men taken are selected carefully and kept circulating from department to department. They spend a week, for instance, in the machine shop; another week in the sub-assembly department; and another in the sheet metal department, purchasing division, or material control. The course lasts 52 weeks. The idea is to give them a bird's-eye view of all processes within the factory, so that when they finally are put in jobs of their own they will have a thorough understanding of what part they are playing.

* * *

We wanted to give you an itemized set-up of a major airline's traffic department this month. Unfortunately, after talking to traffic executives of several major companies, we found the different

(*Continued on page* 72)

EXPERIMENTAL WIND TUNNELS

by RAOUL J. HOFFMAN

BUILDING full-sized airplanes to investigate a new idea has always proved expensive. Therefore, other methods had to be found to reduce cost and decide on the direction of development or further investigation. Testing of models in an artificial airstream, in a wind tunnel, has been found to be the least expensive.

Wind tunnels are convenient because tests may be repeated and quick changes of units made until satisfactory results are obtained. Coefficients are then enumerated for equations that can be applied to predict performances of a new airplane design. With increase of size and airspeed of wind tunnels, the estimated characteristics of an airplane come close to the actual flight performances. The final proof, however, always will be the testing of the finished machine, for there is always the problem of scale effect.

Many other methods have been tried to test designs of airfoils, fuselages and general designs. Some experimenters placed the finished plane on a railroad car as far back as 1890 (Section 1). This was tried again in 1914, when wind tunnel results were compared with the full-sized plane, as sketched in the lower figure in Section 1. In 1890, airfoils were tested outdoors by placing them on a support and exposing them to the wind, as sketched in Section 2.

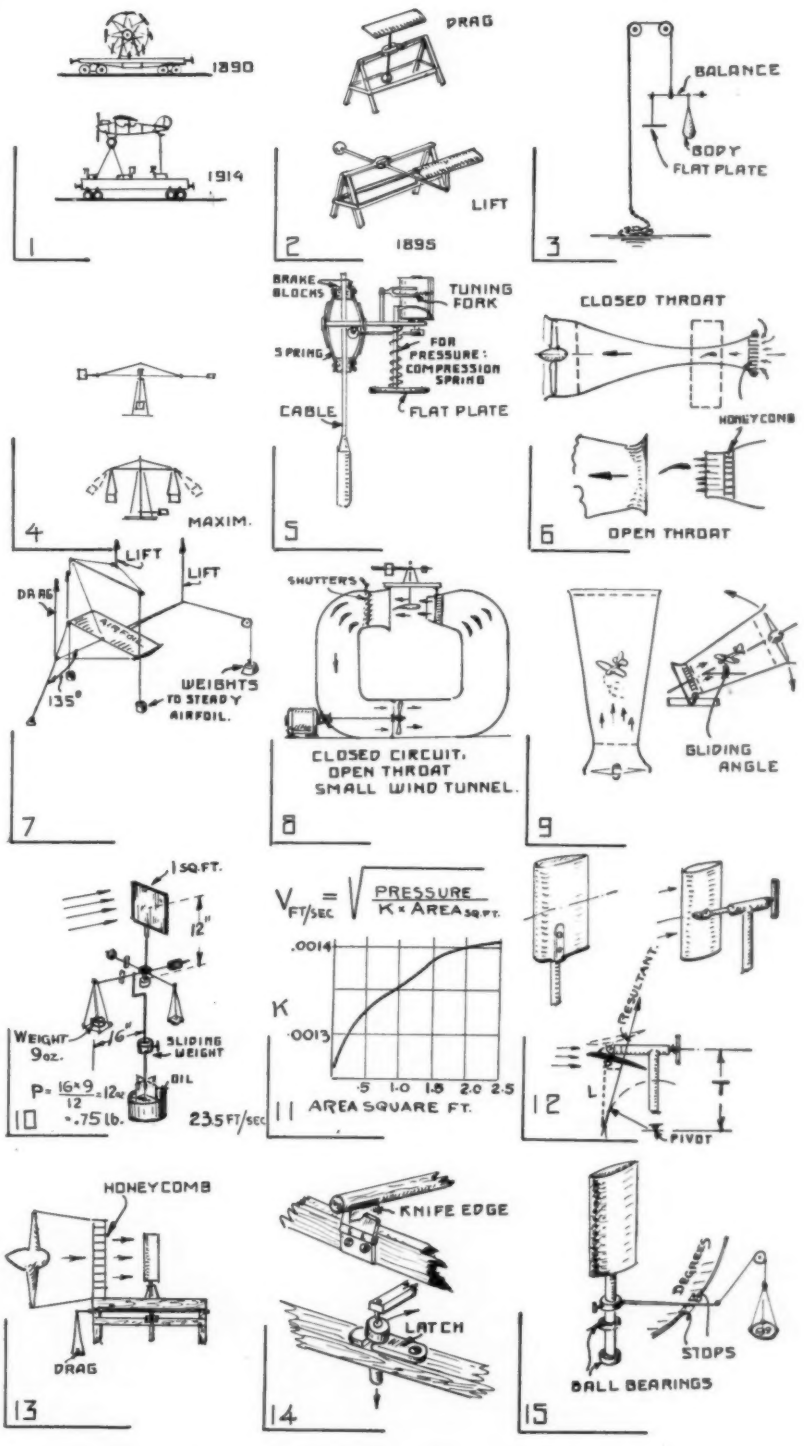
This method, however, gave false results owing to the ground effect and change of wind direction. One scientist built a tower in which a balance was fastened to one end of a cable running over pulleys. It had a chain fastened to the other end to stop the drop of the testing unit. An outline is shown in Section 3. One arm holds the model and the other holds a flat plate. The size of the plate is changed until it balances during the drop. Thus the equivalent flat plate area is found directly.

Some experimenters whirled models in a circular path. These whirling tests proved unreliable, because the air was disturbed and whirled around with the models. Maxim, the inventor, placed himself and the instrument into a small gondola and rotated it at high speed. He also found uneven results, caused by the disturbed air. Maxim, however, found a ready market for his patented laboratory by supplying the well-known airplane swings to amusement parks.

In 1907, Eiffel (the builder of the famous tower bearing his name) stretched a cable between the first platform and the ground to build the instrument sketched in Section 5. The instrument carried a recording drum actuated by a pulley touching the cable. The pressure was marked by a calibrated helical spring and the elapsed time by a tuning fork. Only flat plates and bodies could be tested successfully. Eiffel therefore built a large wind tunnel, which was copied by every country interested in scientific aeronautics.

Numerous small wind tunnels were

(*Continued on page 99*)

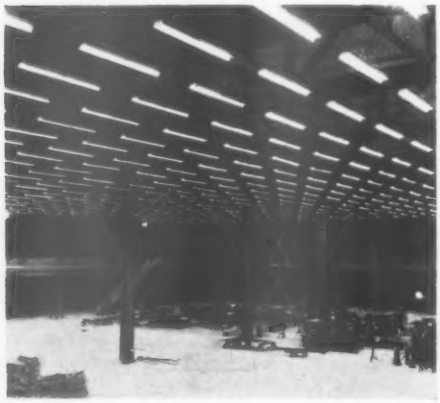


Experiments with small wind tunnels have been in progress for 50 years.

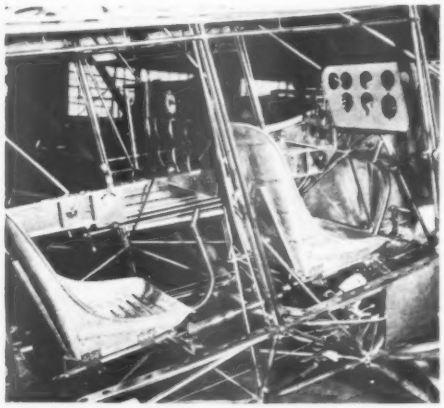
BLACK STAR

This German dive bomber, a Junkers Ju-87, is swooping towards a British merchant ship. At top it's still nearly a mile away; second, half a mile; third, 600 ft.; last two, climbing again.

Army's latest primary trainer is this new two-place tandem Ryan PT-21, which displays several radical departures from previous models. It features air-cooled Kinner engine and revised wing design.

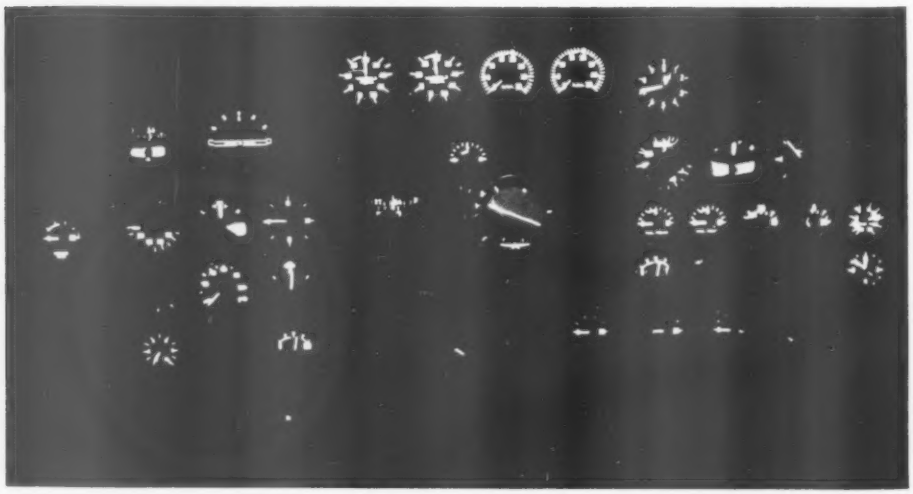


World's largest fluorescent lighting installation illuminates new Burbank, Cal., Vega plant.



This new Rearwin two-place tandem instrument trainer is latest Pan American Airways idea.

Invisible ultraviolet light activates instrument dials' luminous paint in new Air Corps development.



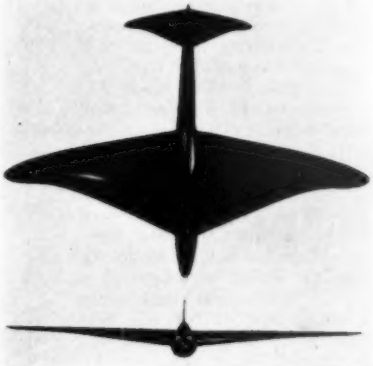
Elimination of rudders, with resultant control simplicity, is feature of General Aircraft Corporation's "Skyfarer," just granted A.T.C. Ship cannot slip, skid, spin, or ground-loop.

BRITISH COMBINE

Mae West picture adorns inflatable life-jacket—called "Mae West"—of RAF pilot.

HAVE YOU SEEN ?

Youngest licensed instructor in U. S. is Merlin Jacobs, Jr., 18, of New Orleans.



ACME

Submerged engine and radical wing design mark Manta Aircraft's high speed fighter.

New "dolly" slides wheels under ski-equipped lightplanes to roll them into hangars.

This unusual modification of Fairey "Battle" high altitude bomber serves as trainer in Canada. Regular glassed enclosure has been removed to make way for twin cockpits.

WILLIAM LARKINS

Coast Guard's new wood wheel chock, shaped like "C," holds front, rear and side.

Fledglings' Timetable

(*Continued from page* 19)

superintendents in the country. He has made a fine record.

Flight instructors agree that the traits that disqualify a candidate for flight training usually become apparent during the first few hours of dual instruction. It is not chance that CAA requires eight hours of dual instructions prior to the first solo flight. If the student cannot coordinate the functioning of his mind, feet and hands; if he does not try to cooperate with the instructor, if he has no ability to repress established reactions and to create new behavior patterns, these defects will be revealed during the first stage of dual instruction. He should not be permitted to solo.

There is another defect that disqualifies some students. That is the academic type of mind. Students of this type—many of them endowed with a high I.Q.—are too active mentally. The safe pilot must be sensitive at all times to the impressions that the ship telegraphs constantly through the controls to him. Such impressions don't register if the mind is too engrossed in an unrelated train of thought.

Such persons frequently are among the most promising students during the early stages of training. Not until after they feel they have learned to fly does the defect become apparent. This is a defect that rarely is discovered during the first eight hours of dual instruction. Additional time in the air is the only test now known that will reveal it.

Prior to the beginning of flight instruction the student should receive ground instruction, as specified in the new CAA Manual No. 50, in the following:

"Familiarization with the airplane, including explanation of controls, throttle, instruments, fuel systems, brakes, instruction signals, use of safety belts, and the location of fire extinguisher and first-aid kit. The student should also be instructed regarding local and special air-traffic rules and warned regarding propeller danger and the starting and running of engines without some qualified person at the controls."

Manual No. 50 also specifies that the first eight hours of dual instruction should include theoretical and practical instruction in:

- Taxiing (into wind, down wind, cross wind, gusty wind).
- Orientation.
- Straight and level flight.
- Medium turns (introducing precision as soon as possible).
- Confidence maneuvers.
- Coordination exercises (elementary eights, "S" turns across road, etc.).
- Flying rectangular courses.
- Normal climbs and glides.
- Climbing and gliding turns.
- Take-offs.
- Landings (90-degree and 180-degree approaches to be introduced as soon as possible with explanation of key position).
- Simulated forced landings (throttle not to be cut below 200 feet altitude and within range of a safe landing area).
- Stalls (power on and power off).
- Spins.

By the end of the first stage of dual instruction, it should be possible for competent instructors to decide, in 99 cases out of every 100, whether the student should be permitted to solo. The physical, mental and emotional traits that mean disqualification usually become apparent during this first period. However, the fact that a person learns slowly should not be considered a disqualifying factor. One of the greatest of the present-day pilots received more than thirty hours of dual instruction before he was permitted to solo. There are many cases on record of slow-learning students who developed into excellent pilots.

"I beg your pardon. Did you say 'switch off'?"

Many of the qualities that make for safe flying can be developed. CAA Bulletin No. 5, The Flight Instructor's Manual, lists the following as "essential qualities of a good pilot that should be developed in the student: Coordination; timing; control touch; speed sense; ability to subdue normal instincts and form new ones by experience; reaction time; judgment; poise; initiative; aggressiveness—as an extension of judgment and initiative; and, analysis and synthesis."

By the time the student is ready to apply for his private pilot rating he also should be ready to appraise his own qualifications impersonally and with absolute realism. Almost anyone can learn to fly well enough to secure a private pilot rating and anyone who receives the rating can fly safely all the rest of his life if he will observe four simple rules: Never take off without first checking the control column, brakes, etc.; never take off after dark; never fly into a storm; and *never stunt*. The student who desires to become a professional pilot must find out whether he possesses those plus qualities that will enable him to stunt if necessary; to fly through storms and to fly at night.

The airline pilot must possess those plus qualities. He must possess the orderly, thorough, painstaking mentality of the born engineer. He must have a pronounced aptitude for mathematics. He must master the science of aerodynamics and the newer sciences of airline meteorology and aerial navigation. And he must know how to use them daily.

He must understand the principles of radio transmission and reception. He must understand the construction and functions of all the various flight instruments. He must possess the qualities of mind and body that will enable him to become a scientist, a capable administrator and a master of many crafts as well as a pilot.

Because the major purpose of Boeing School's flight department is to train airline pilots, our procedure differs somewhat from the procedure of many other schools. It is necessary, of course, to conform strictly to the requirements of the CAA as outlined in Manual No. 50. This Manual, published in December, 1940, is based on the accumulated knowledge of many flight instructors. Common experience has demonstrated that the average student is not able to qualify for a private pilot rating after only 35 hours of flying including the initial eight hours of dual instruction.

At Boeing School we prefer to give approximately 21 hours of dual instruction and approximately 29 hours of solo practice before advising the students to apply for a private pilot rating. The time devoted to each maneuver varies with the individual but, in general, approximates the following schedule:

BEFORE PRIVATE LICENSE	HOURS Dual	Solo
Preliminary work before solo	8:00	....
Check taxi, take-off, circuit of field, landing and practice of same	1:00	1:00
Practice taxiing, take-offs, circuit of field using rectangular courses, and landings	....	3:00
Dual on taxi work, take-offs, rectangular courses, 180- and 360-degree precision landings	1:00	....
Solo practice on taxiing, take-offs, rectangular courses, 180- and 360-degree precision landings	....	1:00
Check on foregoing maneuvers	1:00	....
Dual on taxiing, take-offs, rectangular courses, climbs, turns and climbs, stalls with and without power, steep turns, slips and spins, landings	:50	....
Solo practice on taxiing, take-offs, rectangular courses, 180- and 360-degree precision landings	....	3:00
Dual on taxiing, take-offs, rectangular courses, stalls, steep turns and 720-degree spiral approaches and landings	:50	....
Dual on taxiing, take-offs, rectangular courses, gentle 8's around pylons, landings	:50	....
Solo practice taxiing, take-offs, rectangular courses, gentle 8's around pylons, landings	....	3:00
Dual on taxiing, take-offs, rectangular courses, medium 8's on pylons, landings	:50	....
Solo practice on taxiing, take-offs, rectangular courses, medium 8's on pylons, landings	....	2:00
Check taxiing, take-offs, rectangular courses. 720-degree approaches and landings	:50	....

(*Continued on page* 60)

PIPER POINTS THE WAY TO *More Pilots for America's Planes*

IN THE U. S. CIVILIAN PILOT TRAINING PROGRAM THE PIPER CUB TRAINER OUTNUMBERS ALL OTHER PLANES COMBINED BY MORE THAN 300%

DESIGNED, engineered and built for flight instruction, the Piper Cub is America's outstanding training plane. For years the Cub has provided initial flight experience for hundreds of today's airline pilots, military pilots and flight instructors. Now, with need for fliers the greatest in America's history, dependable Piper Cubs are ready and able to train pilots more quickly, more economically, more safely and in greater numbers than ever before. You can readily ascertain that the Piper Cub is unsurpassed for pilot training by enjoying a free flight demonstration with your Piper Dealer.

DOWN PAYMENTS BEGIN AT

$333

EASY MONTHLY INSTALLMENTS

FREE FLYING COURSE in his own plane is offered the purchaser of a new Piper. It consists of eight hours of dual flight instruction under a government-licensed instructor . . . take-offs, landings, taxiing and fundamental air maneuvers. At the completion of this free flight course the average person is ready to solo.

FREE FOLDER showing all the new Piper planes will be sent you on request or may be obtained from your Piper Dealer. Or, if you wish a copy of the new Piper deluxe, full-color, 16-page catalog, it will be gladly mailed you, providing you enclose 10c in stamps or coin for postage-handling. Piper Aircraft Corporation, Department PA81, Lock Haven, Pennsylvania, U. S. A.

Tune in "Wings of Destiny" NBC Every Friday 10 P. M. (E.D.S.T.)
Continental "65" Piper Cub Given Away Each Week

PIPER **OUTSELLS ALL OTHER LIGHT PLANES COMBINED**

Solo practice taxiing, take-offs, rectangular courses, 720-degree spiral approaches and landings	....	2:00
Dual on taxiing, take-offs, rectangular courses, steep 8's around pylons and landings	:50	....
Solo practice taxiing, take-offs, rectangular courses, steep 8's around pylons and landings	....	2:00
Check on maneuvers as required	:50	....
Dual cross country	1:30	....
Solo cross country	....	5:00
Solo practice on foregoing maneuvers as required	....	2:30
Check taxiing, take-offs, rectangular courses, 8's on pylons and landings	1:00	....
Solo practice on taxiing, take-offs, rectangular courses, 8's on pylons and landings	....	2:00
Check taxiing, take-offs, climbs, stalls, spins, 720-degree precision turns and landings	:50	....
Solo practice taxiing, take-offs, climbs, stalls, spins, 720-degree precision turns and landings	....	2:00
Check all maneuvers required on private flight test	1:00	....
Practice all maneuvers required on private flight test	....	1:20
Approximate time for private pilot rating	21:10	28:50

Following the transition to the four-place cabin jobs, difficulties arise for instructors and students alike. Because the students have received their private ratings, they have a new degree of confidence which is a very real asset to them in the training that is ahead. Competent instructors strive to increase that confidence from lesson to lesson.

At the same time it is necessary to begin "turning on the heat" by insisting on a greater degree of precision in the various maneuvers, prompter and more independent decisions, faster reaction time, increasing sensitivity of touch control, increasingly better coordination, timing, and judgment.

During this period, a certain percentage of the students, for all their confidence, reach their maximum development. Such students should never be given a commercial rating, no matter how many hours they may log eventually. This is no reflection on the individual as a scholar and gentleman and all around good citizen. It is simply that some persons have what it takes to make a professional and others lack what it takes.

This truth is accepted in every field of endeavor. Consider the game of golf. Of thousands who play an acceptable game, only an occasional person finally emerges able to play the courses consistently at par. It would be amazing if it were otherwise. It would be more amazing if every one who learns to fly should finally emerge as a professional pilot.

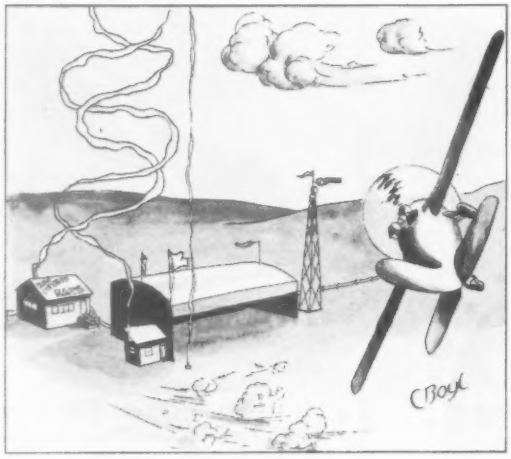
One of the hardest tasks of the conscientious instructor is to persuade ambitious students who lack these plus qualities to abandon the idea of making flying a career. Invariably such students seem to feel that, if they quit, they will be confessing failure. It's nothing of the sort! It is merely a commonsense acknowledgement of inherent limitations that can't be changed.

For students who earn their private pilot ratings and who buy additional time that leads to commercial ratings, the requirements of Manual No. 50 are designed to insure adequate instruction in the use of radio aids, night flying over lighted airways, cross-country flights of at least 300 miles, and other details that make for competence and skill.

The provision that each student must act as an instructor for 10 hours during this period is a desirable feature. In order to learn a thing thoroughly, one should try to teach it to others. An intelligent student will begin to see his own weaknesses when he begins to teach his instructor.

If anything is lacking in the procedure required by Manual No. 50—and this is a matter of personal opinion—it is the failure to require instruction in acrobatics. There always is a possibility that some time, somehow, a pilot will be compelled by circumstances to perform one of the unusual maneuvers classified as acrobatic. Under such conditions, survival of the untrained pilot is sheer luck. Many experienced instructors believe that the special equipment required for such training should be available for all advanced students.

After earning the commercial rating, the students who desire to qualify for airline work should receive 12 to 16 hours in the Link Trainer and 10 to 12 hours under the hood in the four-place cabin planes. Time then is required in the twin-engined ships. For those who are employed as co-pilots there follows three to five years of additional training under the watchful supervision of flight captains prior to promotion to the rank of reserve captain and another two to three year period before the coveted rank of captain is achieved.



"Confusing, ain't it?"

Students who buy time after they receive their private pilot rating should follow a carefully-planned schedule. Random flying is a waste of money. Different periods of time are required for the mastery of different maneuvers. After the first 50 hours of dual and solo flight, the advanced student will have to buy a minimum of at least 125 additional hours before trying for the commercial rating. Experience has shown it possible to schedule 105 hours of this time for specific practice. The additional 20 hours should be left unscheduled, to be devoted to those maneuvers that are most difficult to the individual.

The following schedule indicates the time required by the average student to master the maneuvers required by Manual No. 50 prior to application for the commercial rating:

AFTER PRIVATE LICENSE	HOURS Dual	Solo
Dual taxiing, take-offs, rectangular courses, approaches with use of flaps and without, and landings in four-place cabin plane	1:00	....
Dual cross-country	2:00	....
Solo cross-country	....	13:00
Practice of commercial maneuvers as required	....	3:00
Dual on taxiing, take-offs, rectangular courses and precision landings	:50	....
Practice on taxiing, take-offs, rectangular courses and precision landings	....	2:00
Check taxiing, take-offs, rectangular courses, 8's around pylons and landings	:50	....
Practice taxiing, take-offs, rectangular courses, 8's around pylons and landings	....	1:00
Check on taxiing, take-offs, rectangular courses, climbs, stalls, spins, steep turns, glides and landings	:50	....
Practice taxiing, take-offs, rectangular courses, climbs, stalls, spins, steep turns, glides and landings	....	2:00
Check general air work	:50	....
Practice general air work	....	2:00
Dual taxiing, take-offs, rectangular courses, advanced orientation and acrobatics	2:00	....
Practice taxiing, take-offs, rectangular courses, advanced orientation and acrobatics	....	2:00
Practice taxiing, take-offs, rectangular courses, glides with and without flaps and landings in 4-place cabin	....	6:00
Dual taxiing, take-offs, rectangular courses, approaches and landings (night flying)	1:00	....
Dual night cross-country	3:00	....
Solo night flying	....	6:00
Practice of maneuvers as required (open airplane)	....	2:00
Check taxiing, take-offs, rectangular courses, climbs, glides, on precision landings	:50	....
Practice taxiing, take-offs, rectangular courses, climbs, glides, on precision landings	....	2:00
Check taxiing, take-offs, rectangular courses, 8's around and on pylons (30 and 45 degrees) and landings	:50	....
Practice taxiing, take-offs, rectangular courses, 8's around and on pylons (30 and 45 degrees) and landings	....	2:00
Check taxiing, take-offs, rectangular courses, climbs, stalls, spins, steep turns, glides and landings	:50	....
Practice taxiing, take-offs, rectangular courses, climbs, stalls, spins, steep turns, glides and landings	....	2:00
Dual taxiing, take-offs, rectangular courses, climbs, lazy 8's, chandells, glides and landings	:50	....
Practice taxiing, take-offs, rectangular courses, climbs, lazy 8's, chandells, glides and landings	....	2:00
Check taxiing, take-offs, rectangular courses, 8's around and on pylons (30, 45 and 70 degree banks) and landings	:50	....
Practice taxiing, take-offs, rectangular courses, 8's around and on pylons (30, 45 and 70 degree banks) and landings	....	2:00
Check taxiing, take-offs, rectangular courses, 180, 360 and 720 degree spiral approaches and precision landings	:50	....
Practice taxiing, take-offs, rectangular courses and precision landings	....	2:00
Dual taxiing, take-offs, rectangular courses and power approaches	:50	....
Practice taxiing, take-offs, rectangular courses, and climbs, stalls, spins, steep turns, glides and landings	....	2:00
Check taxiing, take-offs, rectangular courses, 8's around and on pylons (30, 45 and 70 degrees) and landings	:50	....
Practice on taxiing, take-offs, rectangular courses, 8's around and on pylons (30, 45 and 70 degrees) and landings	....	2:00
Check taxiing, take-offs, rectangular courses, 180, 360 and 720 degree spiral approaches and precision landings	:50	....
Practice taxiing, take-offs, rectangular courses, 180, 360 and 720 degree spiral approaches and precision landings	....	2:00
Check taxiing, take-offs, rectangular courses and forced landings	:50	....
Practice taxiing, take-offs, rectangular courses, general air work and landings	....	2:00
Check all work as required	:50	....
Practice all work as required	....	2:00
Check taxiing, take-offs, rectangular courses, maneuvers as required and landings	:50	....
Practice all maneuvers	....	2:00
Check on all maneuvers	:50	....
Practice all maneuvers	....	2:00
Check maneuvers as required	:50	....
Practice maneuvers as required	....	2:00
Complete commercial maneuver check	1:00	....
Practice all commercial maneuvers	....	2:40
Check all work	1:00	....
Practice all work	....	3:00
Semi-final check	1:00	....

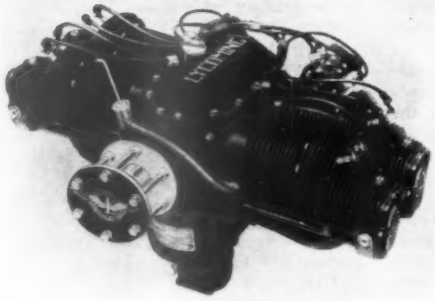
(Continued on page 62)

"Power by Lycoming"

THE ENGINE PREFERENCE
FOR AMERICA'S TRAINING PLANES

IN THE NATIONAL DEFENSE PROGRAM

THE NEW TAYLORCRAFT TANDEM TRAINER WITH LYCOMING 65 H.P. ENGINE



DEPENDABLE, smooth, economical power—that's what the men who fly America's training planes demand. And that's what they get in "power by Lycoming." Flight instructors throughout the Civilian Pilot Training Program praise these blue ribbon engines—for their unfaltering dependability under the widely varying conditions encountered in student training—for their smooth, quiet performance so helpful to the student's relaxation and comprehension of instruction—for their *extra* economy in keeping down gasoline and maintenance costs. Just as Lycoming radials play such an important part in the training of hundreds of Army and Navy fliers, so are Lycoming light-plane engines aiding the cause of national defense by helping create a tremendous reservoir of civilian pilots. Once you *fly* you'll always *buy* "power by Lycoming" for safe, low-cost civilian pilot training.

LYCOMING OFFERS YOU WIDEST CHOICE OF POWER

The widest choice of power in horizontally opposed engines offered by any engine manufacturer! The Lycoming 65-horsepower engine is illustrated. Other blue ribbon four-cylinder models are available in 50, 55, 75, 100 and 125 horsepower and six-cylinder models in 150 and 175 horsepower. All have provision for mechanical or electric starter and accessory drives.

FREE LITERATURE

on Lycoming 50 to 75-horsepower light-plane engines may be obtained from light-plane dealers. Or write Lycoming Division, Dept. P81, Aviation Manufacturing Corp., Williamsport, Penna., U.S.A. Cable address: Aviatcor. (If you wish literature on the higher horsepower horizontally opposed engines, please specify.)

Contractors to the U. S. Army and Navy

YOU CAN RELY ON

LYCOMING

50 to 300 H.P.

Engines

FOR MILITARY AND CIVILIAN TRAINERS ★ FOR PRIVATE AND COMMERCIAL PLANES

Practice all work 3:00
Final check 1:00

The foregoing schedule includes 20 additional hours to be devoted to the maneuvers that have proved most difficult for the individual student. Also 50 (plus or minus) hours preliminary to the private pilot rating. They constitute a guide for instructor and student alike during the 175 hours of flight training that must be given by advanced flying schools before the student takes the test for the commercial rating. In conclusion, it must be emphasized that the new Manual No. 50 establishes a standard of *minimum* essentials and that very few students can expect to qualify for the commercial rating in the minimum time of 175 hours of flying.

END

I Learned About . . .

(*Continued from page* 45)

the propeller switch in the manual position. More of this later.

Everything seemed fine, so I took the yellow sheet from my Plane Captain, signed my acceptance of the plane for flight, and taxied away from the fighter line.

As I taxied toward the take-off spot, I noticed the landing signal officer had laid out his flags (to represent the after end of a carrier deck) on the longer three-ball runway. At the moment he was striding toward the control tower with the obvious intent of asking that the course be changed.

Sure enough, just as I came to the intersection of the one-ball and the three-ball runways, the tower duty officer sent two more balls up the staff, to join the one already there. In view of the light wind, the landing signal officer had had his way. And to his intervention I probably owe my life.

I tightened my safety belt and got squared away for a three-ball take-off. This runway is long, and ends with a 50-ft. drop-off, below which are trees and buildings of Fish Point, a U. S. Marine base. Beyond Fish Point lies Guantanamo Bay.

Several fighters were already in the air and I noted one of them coming around for a three-ball approach. I had already gone over my check-off list properly—I thought—so in order to get off well ahead of the landing plane I hurriedly rechecked the most important points: Propeller—forward. I pushed the automatic control knob. It was already forward. Gas—on main. I put my hand on the selector valve handle. Okay. Mixture—automatic rich. I put my hand on the mixture control. Okay. A glance showed plenty of gasoline in the main tank and all engine instruments gave normal readings. I started to open the throttle and as I released my brakes I noted r.p.m. rising toward 2,000 and manifold pressure rising toward 33 inches of mercury.

Then I turned my attention toward the runway as it sped beneath me. I eased back on the stick, but the plane bounced along still on the ground. I was taking a long run, but it seemed normal enough in view of the airplane's weight and the fact that what little wind there was was on the starboard beam.

With most of the runway gone, I horsed back on the stick and clawed my way into the air. I still wasn't worried. But as the last bit of runway dropped behind me I felt the plane settling. Something wrong!

One quick glance inside the cockpit was all I dared to take, as my left hand instinctively opened the throttle wider. The only instrument that impressed itself upon me was the manifold pressure gauge. It showed just 35 inches of mercury. Not enough! But opening the throttle seemed to do no good at all. In fact there seemed to be a loss of power rather than a gain.

This is going to be close, I thought. I nursed the plane over a tall tree which rose from Fish Point squarely in my path. Flicking the catch on my landing gear, I cranked desperately to get the wheels retracted for a water landing.

Inside my head, thoughts tumbled headlong over one another. But no logical explanation of my difficulty came forth. The engine was still running smoothly, but with little evidence of power. I *knew* the propeller was in a low-pitch position. Hadn't I just checked to see that the control knob was full forward? What then? Carburetor trouble? If so, there was nothing I could do about it. My carburetor was supposed to be non-icing and in any event there was no pre-heat control in the cockpit.

I staggered over the buildings and docks of Fish Point and gingerly managed a graveyard turn to the right, which did three things for me. It headed me into the wind; it headed me between two destroyers at anchor, instead of directly toward one of them; it gave me an unobstructed run up the bay. With three tons of airplane still settling and now only a few feet off the water, I decided to hold what I had and maintain flight as long as possible.

Goggles pushed back from eyes, left hand braced against telescope sight—which object has banged the head of many an unwary pilot—I was all set for a water landing and not particularly worried about the prospect.

For I knew that Grumman makes an airplane which goes onto the water very nicely with its wheels up. Within the past eight months I had seen fellow Ensign E. R. "Slim" Coffman—former Rose Bowl tackle for Alabama—land an F3F-1 in an estuary near Cape Charles, Va. I had read about Robert A. Winston—who needs no introduction to FLYING AND POPULAR AVIATION readers—and his landing of an FF-2 in the water off Floyd Bennett. I had myself landed an F3F-1 in the bay at the Norfolk Naval Air Station. Not one of us had so much as gotten his feet wet.

Still, those had all been biplane fighters, and this was heavier, faster and a monoplane. So I wasn't too relaxed and nonchalant as—

The plane stalled sharply and in a split-second was into the drink. Water

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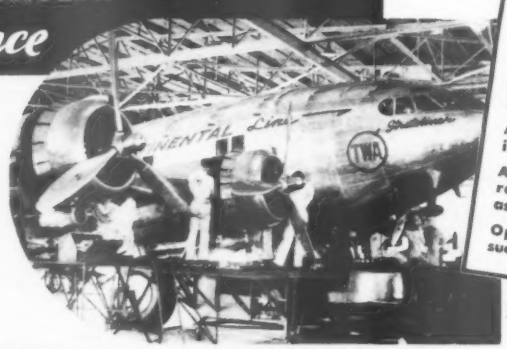

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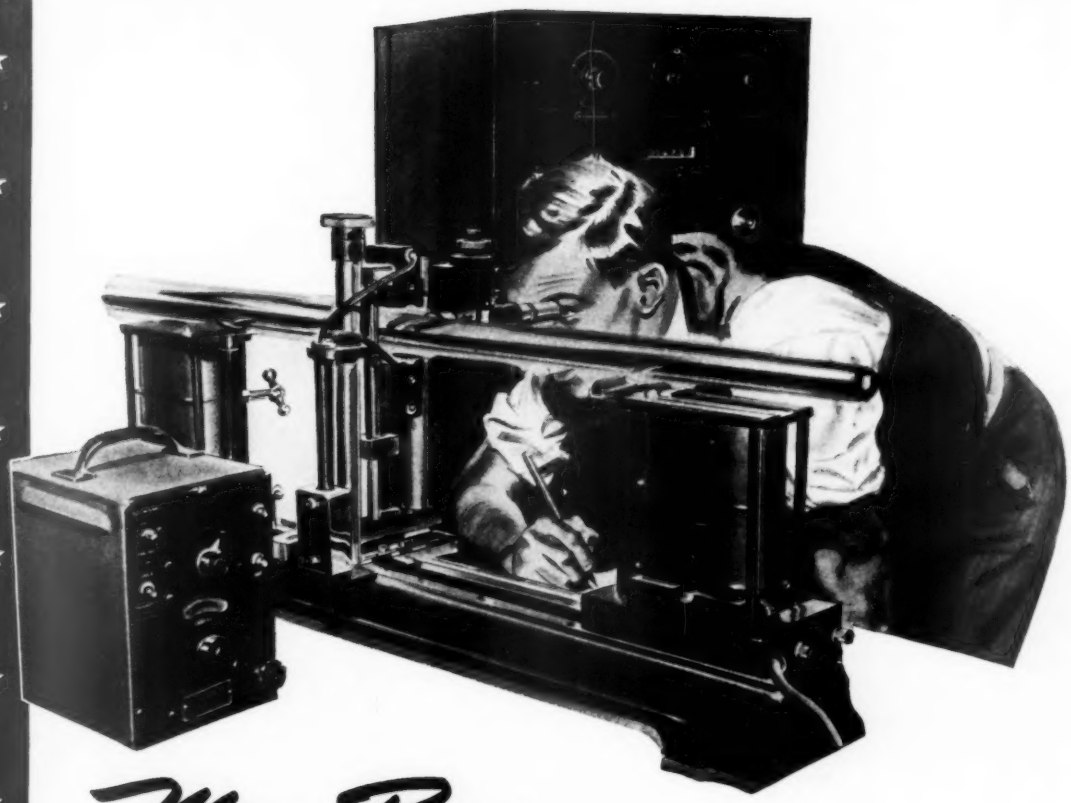

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WRIGHT
Aircraft ENGINES

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flew in clouds on either side and as the tail came up behind me I heard in my earphones the voice of squadron mate Bob Boyd:

"Crash! Crash in the water!"

Then I was flicking my safety belt, lest the plane go on over, or sink. As I stood up and fumbled with my parachute buckles I tumbled ignominiously into the bay. I slithered clear of the 'chute harness and two tugs at my life jacket inflated it with CO_2. Meanwhile, the automatic flotation gear in the wings had functioned beautifully and the plane was floating nicely though considerably down by the head.

Three strokes put me back aboard; I clambered out of reach of any inquisitive sharks and barracuda, stood up on the windshield and waved reassurance with both hands as anxious fighter pilots zoomed overhead.

Then I sat down to take stock of the situation. I was completely unhurt, and could offer up sober thanks as I contemplated the rough hills and obstructions at the end of the one-ball runway.

Rescue craft converged upon me from every direction. First on the scene was a Cuban bumboat, filled to the gunwales with natives who evinced a certain mild interest in my plight, but made no move to stop. They wanted to avoid international complications, no doubt.

Next to arrive was a sleek speedboat from Fish Point. The Marines had the situation well in hand. Motor whaleboats from the destroyers—I had landed squarely between the two "tin cans"—came out to take over salvage operations. I rode back to Fish Point for a routine check-over by the doctor.

I still had no idea as to what had gone wrong. But investigation showed that my propeller switch was set on "manual" rather than on "automatic." I had switched over while the propeller was turning at 2,000 r.p.m. and had neglected to switch back. Consequently the propeller was in a fixed pitch, with approximately 2,000 r.p.m. the maximum possible. The push-pull knob had no effect whatsoever; the only way to get full low pitch when the propeller is on "manual" is to pull the manual switch to one side, marked "increase r.p.m."

Therefore on my take-off, instead of getting 2,600 r.p.m. or more, I had struggled into the air with just 2,000 or so. At the first indication of bogging down, I had effectively killed any chance of staying up by my instinctive action in opening the throttle. All of us as motorists know that when you're climbing a hill in high and the motor shows signs of laboring, feeding more gasoline *won't* help. Of course, in a car you can put on your brakes, stop and think things out—or else you may simply shift into a lower gear.

So instead of opening the throttle and thereby causing detonation and loss of power, I should have "shifted gears"—should have taken proper steps to lower the propeller pitch. The trouble was, I didn't know my "gears" as well as I thought I did.

The fact that the incident could easily have been fatal impressed firmly upon me a threefold lesson:

1. *Learn new equipment thoroughly.* I had become used to a two-position propeller, which utilized full low-pitch for take-off and climb and full high-pitch for cruising. The constant speed propeller was for me something new; and though I had listened to a lecture by a company representative, had read pertinent squadron orders issued by my flight officer and had seen what there was in my pilot's handbook, that wasn't enough. I should have studied the cockpit installation carefully. I should have analyzed the effect of placing the propeller switch in each of its four positions ("automatic," "manual," "increase r.p.m.," "decrease r.p.m."). I should have checked over the propeller with a competent mechanic and should have studied the effect of a short circuit (which will trip an additional safety switch). I should have studied possible mechanical failure which might cause an open circuit (making it impossible to shift pitch either manually or automatically). Careful thought would have pointed out the fallacy in checking the magnetoes on "manual." With a setting of "automatic" and with the push-pull control full forward, the propeller was set to be automatic only at full take-off power, with around 2,600 r.p.m. At 2,000 r.p.m. the compensating device would not be in operation, and a drop-off on either magneto would be recorded just as effectively in "automatic" as in "manual."

2. *Go over the check-off list carefully.* This is something that can't be reiterated too often. Prior to take-off, go down the list point by point, and *assure* yourself that all is well in every particular. Amplify the check-off list if you must. Being sure that the push-pull knob was forward meant nothing with the switch on "manual." Being sure that the fuel-selector valve was on "main" would have meant nothing had there been only two or three gallons in the main tank.

And, of course, never hurry a take-off. If you do, the chances are you'll overlook something and it *might* be something important. So if another plane is coming into the approach circle and it's a question of taking off right now or waiting two or three minutes until it has landed, just wait those two or three minutes and go over the check list again.

3. *Be sure you have full power for take-off.* Be sure that it's getting delivered to your propeller. If there's no other means in your cockpit of ascertaining whether the propeller is in a low-pitch setting, correlate your tachometer readings with your manifold pressure gauge readings. Prior to my take-off, I had noticed over 33 inches of mercury showing in conjunction with no more than 2,000 r.p.m. This should have warned me that all was not well, as a normal reading would give about 28 inches of mercury for 2,000 r.p.m.

So—if your ambition is that worthy one, to be the oldest living pilot—heed my three-point lesson, learned the hard way. It may help speed you on.

END

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Largest cabin of any production light plane trainer. Wider, longer — more leg and elbow room.

Adjustable seats fore and aft with cushions removable for seat or back pack parachutes.

Cruising range 300 miles — 14 gallon gas tank.

Dual sticks and rudder pedals. Dual throttles. All other engine controls grouped together at left of seats within easy reach of *both* occupants.

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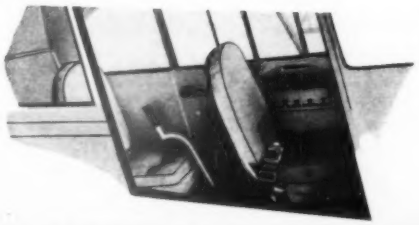

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★ Under the Civilian Pilot Training Program of the United States Government, operators have had tremendous experience with all makes of light plane trainers. That experience has further proved the superior construction and flying advantages which have made Taylorcraft the World's largest selling side-by-side seat airplane.

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After the War . . .?

(*Continued from page 27*)

parts produced at the Lockheed plant exceeded $45,000,000. Today the company has a backlog of more than $274,000,000.

The growth of Douglas, Northrop, North American, Vultee, Consolidated, Ryan, Vega and Menasco has been far beyond anything we dreamed of a few years ago. The employees of Southern California's major aircraft plants and the several small engine companies, together with the employees of the airplane engine builders and the accessory and parts manufacturers, total approximately 100,000 persons.

Today our factories have an aggregate floor space of more than 8,500,000 square feet. We have orders for $1,317,165,000 worth of goods. Each month we produce one-third of the entire nation's airplanes, parts, and supplies. Lockheed alone uses one-seventh of all the aluminum produced in the United States.

Have we grown too fast? Are we so big that we are riding for a fall when the fun is over? Perhaps. I think not. Yet, even if we knew that were true, we still should have expanded every foot of floor space, bought every machine, hired and trained every worker, just as we have done today.

We have prepared, and are still preparing, for any emergency of a military nature that may come our way. The President has asked us to do that. The people have placed their trust in us, and we are doing it. But the foundation of our business is peace, not war.

Few realize it, but in the year 1918, 13,000 airplanes were built in the United States, most of them for use at the front. But that didn't make an aircraft industry. It was not until our Army flyers circled the globe starting from Santa Monica, Navy flyers spanned the Atlantic in their pontooned ships, Admiral Byrd flew over the North Pole, Lindbergh soloed the Atlantic and 100 other pioneers of the air had completed flights requiring equal courage, that the idea of flying began to grip the people. Then we had the beginning of an aviation industry.

Each of those flights contributed to our knowledge of flying, to our experience in building better planes, to speeding the day when people all over the world would look upon the airplane as a commonplace means of travel.

Just now we are dedicated to an "all out" effort for defense. Peril hems us in. We must meet fire with fire and in these days that means meet warplane with warplane. But every manufacturer in the industry is looking ahead to a world of peace in which the industry may carry on the normal advance of commercial and private aviation.

A large percentage of the profits being made from war orders are being turned back into the business to finance the development of safer and faster commercial planes for tomorrow; to the building of pleasure craft and passenger planes in a volume that will enable the industry to utilize its greatly augmented facilities after the war.

And what will be the aviation developments of tomorrow—of, say, 1950? The woods are full of people who, in 1930, guessed what 1940 would bring—and guessed wrong! How far we all underestimated the progress of the last 10 years! How, then, dare anyone predict with certainty what the *next* 10 years will bring? Even five years is dangerous ground, not for fear of overstatement, but of understatement.

We have learned in the past 10 years that that which man can clearly vision, he can do. He needs only an achievable goal; a definite incentive. That incentive, as far as the progress of the next 10 years is concerned, must be the desire of the public to go places by air. It is this public, people in all walks of life who may wish to travel, or fly for pleasure, who will tell *us* of the aviation industry how high, how far and how fast we will fly in 1950.

If that demand requires travel at 400 or 500 m.p.h. or faster in the sub-stratosphere, we can and will build planes to fill these demands. If the public wants, in commercial quantities, a small 150 or 200 m.p.h. plane for private use that will be safer than your automobile, I am satisfied that we will be able to build it for you by 1950, or sooner.

The president of Pan American Airways recently announced that his company is planning to inaugurate within the next year a daily, nine-hour service to Honolulu from Los Angeles, a distance of 2,600 miles. It now takes 18 hours for the clipper ships to fly from San Francisco to the Hawaiian Islands, a slightly shorter distance. Lockheed has a plane designed and ready to build that will double the speed of the present clipper ships. We shall build it when time and our war effort will allow.

Many aeronautical engineers believe we are entering the era of multi-engined planes for large passenger loads. They expect to see land planes used for overseas, as well as land flying. These planes lend themselves to better streamlining. This means higher speeds, longer flying range, greater safety and, at the same time, a lower operating cost per mile. With four engines, there is no reason for any plane being forced down.

The next major development in multi-engined transports, according to these same aeronautical engineers, will be a plane weighing 70 tons, engineered to fly in the sub-stratosphere at about 400 m.p.h. It will, in all probability, be powered with six engines. It could fly from Los Angeles to London in 12 hours. This is not a dream plane. Engineers actually are at work on its design.

We know from experience that the top speed for airplanes has not yet been reached. We know that what can be done with a military ship, which must carry attack and defensive equipment, can be done with commercial ships. Size, with proper designing and engineering, is not a handicap to speed when suitable power is available.

(*Continued on page 68*)

Be One of Aviation's MOST VALUED Men...

...the Aeronautical Engineer

Aviation prizes the engineers in the industry today . . . is urgently calling for more and more to lead the advance in the ever-greater aircraft developments of the years to come. Aeronautical engineering is a fascinating, well-paid field from the very start—but it calls for men who are interested in much more than immediate gain . . . as it leads to the greatest heights of personal achievement and success in all Aviation.

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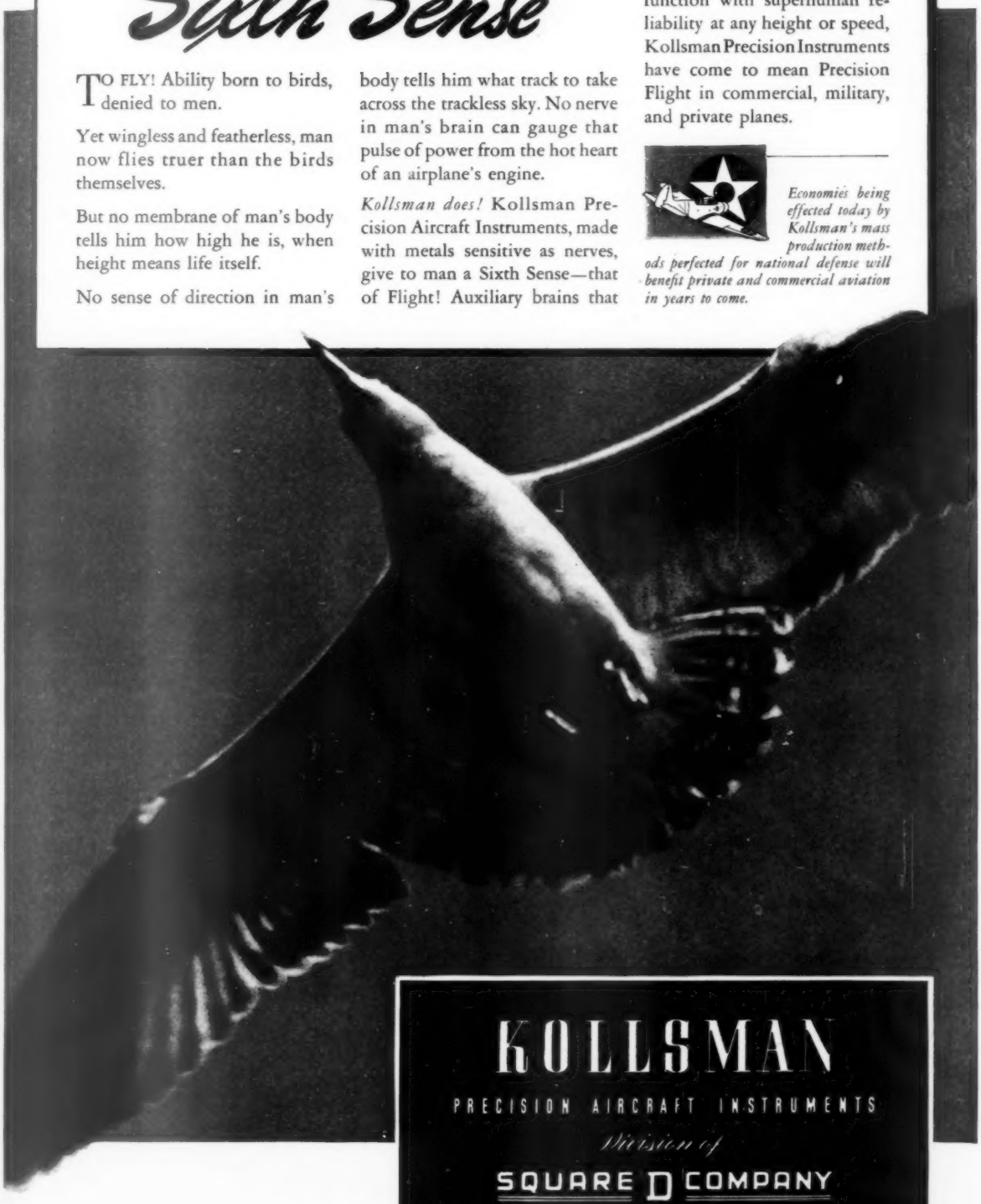
But no membrane of man's body tells him how high he is, when height means life itself.

No sense of direction in man's body tells him what track to take across the trackless sky. No nerve in man's brain can gauge that pulse of power from the hot heart of an airplane's engine.

Kollsman does! Kollsman Precision Aircraft Instruments, made with metals sensitive as nerves, give to man a Sixth Sense—that of Flight! Auxiliary brains that function with superhuman reliability at any height or speed, Kollsman Precision Instruments have come to mean Precision Flight in commercial, military, and private planes.

Economies being effected today by Kollsman's mass production methods perfected for national defense will benefit private and commercial aviation in years to come.



KOLLSMAN

PRECISION AIRCRAFT INSTRUMENTS

Division of

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Hand in hand with increased speed comes increased passenger comfort, increased safety and increased travel by air. The genius of the American aeronautical engineer is such that the airliners which are used on all of our domestic airlines are fast being accepted as the standards of the world. Wherever one cares to travel by air today, it is not only possible, but very highly probable, that the trip will be made in an American-made airplane.

This sale of our commercial airplanes to foreign airlines is enabling the American manufacturer to entrench his products in foreign fields. When war is forgotten, and the airplane manufacturers in the belligerent nations again find themselves able to compete in the commercial markets of the world, they will find it very difficult to regain the place they formerly held.

This is particularly true in South and Central America. There they are turning toward us in an eager, receptive mood. The future of aviation in Latin-America has no horizon. It is limitless and can go just as far as the peoples of Central and South America want it to go.

The first Pan American Airways clipper ship flight with passengers across the Caribbean Sea took place in 1930. Now "Flying Down to Rio" is accepted as a matter of course. In 1935, Pan American inaugurated its trans-Pacific service, first as far as Honolulu, later extending it to Manila, Hong Kong, Australia and New Zealand. The year 1939 saw the establishment of scheduled clipper flights across the Atlantic.

But the aviation industry really came of age in 1940. The impetus the industry received from new and large orders, both military and commercial, was sufficient to secure beyond any doubt the future of aircraft manufacturing.

Parallelling this future in commercial aviation, with its super-airliners that pierce the sub-stratosphere and span the seven seas, will be the building of fast, safe and economical private planes. Many will be of the "flivver" class. The price will be lowered to a point where they will be within the reach of hundreds of thousands of persons. It will not be much more difficult to learn to fly them than to learn to drive an automobile under present traffic conditions.

These planes are going to encourage travel on a scale we have not heretofore believed possible. It will open resorts and playgrounds which in the past were believed too far from population centers to be visited during the customary two-week vacation.

At great cost, the nation has built thousands of miles of highways to serve the automobile. With the advent of the greater use of private planes, which is coming as surely as the automobile came, we will have to build hundreds of additional airports for them. The cost will be small compared to the cost of laying the great concrete highways. I believe that every city of 5,000 or 10,000 population and up will have its airport or airports, modern in every detail. They may be built at public expense, just as the roads and boulevards now are being built.

Salesmen will have to become pilots. I can conceive the greater use of the airplane as being a boon to sales managers with large territories. Annual and semi-annual sales meetings in the field will not then be the headaches and time-wasting affairs they are today.

The airplane is gradually shrinking the map of the world. That shrinkage is taking place faster than man's comprehension of the full meaning of the changes that are going on. We cling more closely to the past than we realize. We still are inclined to measure distances in terms of speeds at which we have been accustomed to travel. But if we are to readjust ourselves to the age of aviation, we must condition ourselves to think in terms of airplane speeds. Distances, measured in months of travel a half-century ago, have been shrunk to days, to weeks, to hours, to minutes.

From old Dobbin to the automobile was one step. To the airplane is another. I will predict that within five years, and certainly within 10, many manufacturers in the United States will be sending salesmen out to contact customers in distant lands by airplane, just as they send them out today to contact customers by automobile. The men on those missions will have to speak the language of their customers; they will have to understand their problems, just as successful salesmen do today. They will be commercial emissaries, specially trained for their assignments.

Salesmen of five and 10 years hence will be just as conversant with the latest developments in the airplane, and airplane travel, as they are today with new model automobiles. They will use commercial airlines to reach distant points as regularly as they now use the train. Thousands of new salesmen will be employed by the aircraft companies, some in contacting commercial accounts, but most of them in selling private planes to the huge new market.

The salesman of tomorrow, like Mercury, will blaze his way through the skies of many lands. On his expense account will be many new items, but since most sales managers will have pioneered the airways ahead of him, I wager it still will be just as difficult as ever to hide an overcoat or a new pair of shoes on his swindle sheet.

END

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ALL-OUT, ALL-INCLUSIVE ISSUE ON THE UNITED STATES ARMY AIR CORPS ...THE MOST INFORMATIVE AND MOST COMPREHENSIVE REPORT ON AMERICAN MILITARY AVIATION EVER PUBLISHED.
SEE ANNOUNCEMENT ON PAGES 78 AND 79

Miracle Merchants

(*Continued from page* 26)

Sperry has three new and very important safe flying aids, either under test or just recently in production. At least one promises to revolutionize instrument flying. This is the famed Klystron tube, the idea of two Stanford researchers since transplanted by Sperry to its research laboratories in the old Curtiss motor plant at Garden City, Long Island.

Sperry already has the practical blind landing instrument, the Flight Ray, but no practical radio beam is straight or concentrated enough for the purpose. The eight-inch experimental copper-and-glass Klystron tube generates and aims a straight, narrow beam of ultra-high-frequency microwaves. Planes could ride down the straight and slightly tilted Klystron beam in zero-zero weather. Or the Klystron could be used as a sonic altimeter, is strong beam, rebounding warning of obstructions—stuffed clouds—a mile ahead.

There is a waiting market for the Klystron. In the old days all pilots seemed to be from Missouri. When the first gyro horizons went into service most pilots thought they were unnecessary and pre-

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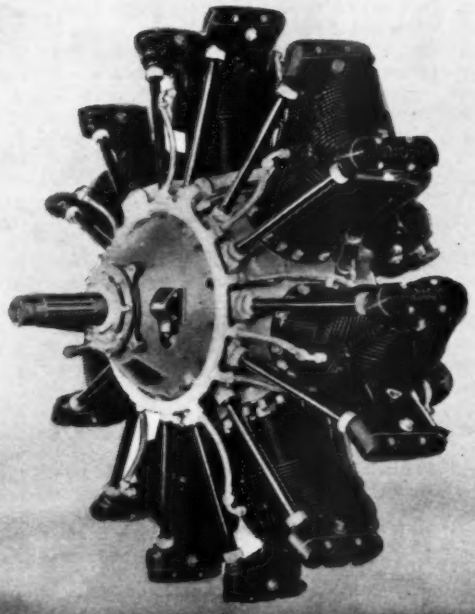

JACOBS ENGINES

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ferred to fly "by the seat of their pants". It took the U. S. services to prove that even birds, when blindfolded, cannot fly. Blindfolded pigeons instinctively set their wings at the correct dihedral angle, lowered their flaps, so to speak, and glided to the ground, where they stayed until the blindfolds were removed.

Airline pilots, too, were skeptical of automatic pilots at first. But it wasn't long before one airline official said on the radio: "The gyro pilot, by actually flying Douglas airliners, affords the pilot and co-pilot additional time to operate the radio, study maps and terrain, supervise operation of the twin engines, but most important of all, allows the pilots to be fresh and rested during landings and take-offs."

Instruments multiplied until the modern instrument panel overflowed to the walls, the ceiling and even the floor of the cockpit. Now the trend is reversed. Sperry realized the very complexity of installations was a threat to safe flying and began to work toward the panel simplification by combining flight instruments.

The automatic or gyro pilot, combining the gyro compass and gyro horizon, is a tremendous improvement. Not only does it free the pilots for navigation, observation and radio communication, but it eliminates the fatigue of manually controlling the larger planes at higher altitudes, or of long stretches of instrument flying. Celestial navigation on long over-water hops is done with an accuracy hitherto impossible. This is because the gyro-pilot holds the ship on a steady course as close as ½°, whereas it is difficult with manual control to steer a course closer than 2°. The gyro pilot reacts more quickly and smoothly than the human pilot, which is very important from the passengers' point of view, especially in rough weather. Sperry gyro pilots fly 100,000 miles a day on 19 of the world's leading airlines and in at least 12 governments' fighting cockpits.

The gyro pilot is a box roughly a foot square. The directional gyro is mounted on the left, the gyro horizon—or climb-and-bank gyro—on the right. When the automatic pilot isn't engaged, both these instruments are read as usual. Both gyros are driven by a tiny jet of air and are mounted flexibly, free to move around three axes. More correctly, when the plane turns on any of its three axes, climbs or dives, rolls, or turns, these spinning gyros hold their fixed position. The plane and the automatic pilot proper actually turn around the gyroscopic rotors and, in so doing, uncover ports through which air is driven under pressure. This pressure actuates a diaphragm attached to a sliding valve—something like the steam-locomotive valve—in a separate hydraulic system. This valve, in turn, permits oil to flow to a triple cylinder and piston arrangement which moves elevators, rudder and ailerons. Motor driven oil and air pumps supply power for the gyros and the pistons.

Just picture the gyros as the "brain", the air diaphragm and the sliding valves as the "nerves" and the pistons as the "muscle". Yes, "George" is almost human, but he detects smaller departures from the flight path and acts on the controls with less delay than his human counterpart. He can't overcontrol and in an emergency a small relief valve enables the human pilot to overpower the automatic one.

"George" will be just a workhorse soon. Sperry's quest for instrument simplification has spawned a sort of one-man-band among instruments: the Flight Ray. Core of the Flight Ray is a cathode ray tube. On its three-inch glass face are projected simple illuminated symbols, giving readings for the directional gyro (heading); gyro horizon (climb-and-bank); airspeed (relative to the ship's speed range); and position of the ship relative to the radio beam or the radio landing beam.

Let's suppose you are coming in for a blind landing at Municipal Airport. There is the usual tiny airplane silhouette painted on the Flight Ray's face. The horizon is represented by a thin lighted line similar to the artificial horizon line in your old gyro horizon. Your heading appears as a small pointer at the top of the dial, moving left or right as the ship deviates from its proper course. Airspeed is a short bar that moves toward the top of the dial as speed picks up, toward the bottom as you approach a stall. A small circle that meanders all over the dial is the radio or landing beam. A buttonlike purple light in the upper left corner of the instrument, outside the glass face, flashes as you pass over the outer airport beacon marker. A red light in the opposite top corner flashes for the inner beacon marker.

All you do once you are on the beam is keep the tiny beam circle smack on the silhouette's nose, the horizon line coinciding with its wings, the heading indicator centered at the top of the dial and the airspeed bar above the stall warning mark at the bottom of the dial. You adjust your speed as purple and red flashes indicate first the outer and then the inner airport marker beacons. Simple? Brother, you're a push-button pilot now.

Sperry, working in close co-operation with other companies, has reduced airline navigation to its almost irreducible minimum. The Sperry direction finder installed on TWA, Braniff and American has made navigation a simple matter of tuning in a radio station. With the old D-F you tuned in two or more stations and plotted position by the intersecting bearings. The Sperry D-F's pointer gives a continuous bearing on any station selected. And, although orientation problems are still worked out in the same old way—but easier—the new D-F can be tuned to a station at the destination and the ship flown there by following the pointer. A regular directional antenna, plus a small sense antenna, permit the pilot to tune a station and hold it automatically, while course changes are noted by the D-F's pointer. Passing over the station the pointer swings through 180° and continues to follow the station even if the ship circles it. Sperry's D-F is designed as a complete navigational instrument.

All this is miraculous to an outsider, but it's everyday accomplishment to Sperry. Every instrument which leaves the plant is an achievement in pure science.

Sperry research keeps five years ahead of current production. Research engineers have unmatched equipment in their Garden City laboratories and the Lockheed "14" "flying laboratory". You can get a precise bearing on the future from Tom Morgan's 1940 report to stockholders:

"In making my estimate of the future we must remember that two of our fields are relatively new. Hydraulics and aviation, in my opinion, stand today at the forefront as relatively untouched frontiers of American industry."

END

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

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Spartan "Executive" all-metal planes are known the world over as shining examples of superb creative engineering. At the Spartan Aircraft Factory, advanced students of the Spartan career course in Aeronautical Engineering serve a 12-week apprenticeship with experts of the profession. *Only at Spartan School of Aeronautics do you receive actual factory design and production experience as part of your training in Aeronautical Engineering.*

Intense practical experience and thorough engineering study are blended to make this 24-month Spartan course one of the most valuable aviation courses available today. You learn engineering fundamentals under experienced instructors in Spartan's 27 modern classrooms, laboratories, shops and hangars! You test your skill and knowledge under the close supervision of the Spartan Aircraft Factory's Chief Engineer and Plant Superintendent! You use expensive machinery and tools that only a modern school and factory can provide! You graduate with a practical knowledge of latest factory engineering and production methods!

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Send me your new 1941 Catalog describing in detail the SPARTAN courses I have checked; also stating tuition and living expenses.

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CHECK COURSES YOU PREFER

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- ☐ Aircraft or Engine Mechanic
- ☐ Commercial Pilot
- ☐ Air Transport Radio Communications
- ☐ Private Pilot
- ☐ Aircraft Factory Mechanic

(4)

Want a Job?

(*Continued from page 54*)

airlines to be at such variance in their organizations that we hesitate to go on record except to state generalizations which might be applied to any of them.

An airline's traffic department is concerned with the selling of a commodity—swift transportation—which the operations division makes available. If you want to become an airline traffic man, you should have approximately the following qualifications: a high school education (college education preferred), a pleasing personality, youth and inherent sales ability. They may put you in a ticket office, or they may, if you have had previous transportation sales experience, put you to contacting companies whose executives or clients are good potential customers for airline travel. You may be employed in their mail, express, or freight divisions, where you try to convince people it would be cheaper and more expedient to ship their product by air than it would by the means they currently are using. One thing can be said: if you are a salesman and have a good knowledge of the aircraft industry, you will have a place in traffic work.

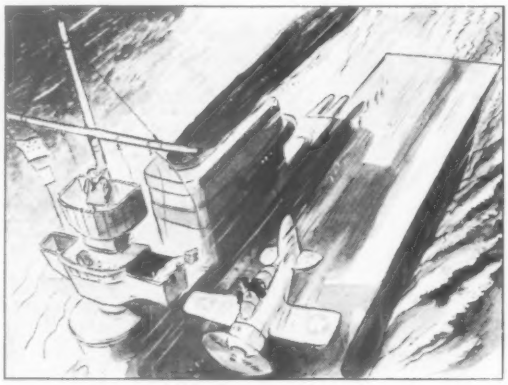
Consider the elements with which you would be confronted if you were selling airline service and you will have a good idea of the various jobs that exist in the traffic or sales set-up of a major airline. Remember always that there is no strict line of demarcation between operations and sales and that if you are a ticket representative in a small town you may be required to be airport station manager as well. In the latter capacity you would be responsible for the servicing and dispatching of ships passing through your station. A job of this sort, therefore, would require an individual knowledge far beyond the salesmanship principles. You would have to be versed technically in transport airplane operation and at the same time be thoroughly familiar with all the problems of any man working for you in that station. If you're selling tickets in Fresno, Cal., and a transport comes in with brake trouble in the middle of a deep fog (annoyingly indigenous to that country), you would have to know what caused the fog, what its possible duration was likely to be and what was wrong with the brakes. You also would have to reassure your passengers as to just why they had been delayed and possibly at the same time sell a potential passenger, who had never flown before, a ticket to Seattle.

The progressive steps toward getting important jobs in the traffic business are these: You get hired. Then you learn something about the airplane business. After that, you are stuck into some job where your knowledge is useful to the guy who hired you. The more technical knowledge you have, the better job you will get in the first place; and the more you try to learn about the business, the faster you will go ahead.

* * *

S. H. Y., St. Petersburg, Fla. We're glad you've got the job and we're doubly glad that we had something to do with helping you. An airport manager's job is concerned principally with field and flight equipment, with maintenance, the supplying of flight aid to pilots, the physical control of traffic, the enforcement of CAB and/or local regulations and airport service exploitation. The knowledge necessary competently to fulfill these requirements naturally will vary with the airport's size and the amount and types of traffic it handles.

Your inquiries as to CAB requirements for an airport manager are rather hard to answer without knowing your local field's specific problems. Briefly, though, you must have a rating in any of the specialized functions like radio, meteorology, dispatching, etc., which your services may require you directly to take care of.



"I wish you Navy men would cooperate with us flyers. How about slowing down so I can land?"

If you had the necessary appreciation and understanding of your particular set-up's problems and it were a large enough deal to call for executive and sales talent of a high order, you might need no special certifications at all, but could employ specialists in all lines to carry through your ideas.

As to whether an airport manager should be a pilot, we believe he should. Or if not, he should have long experience as a ground operations specialist to substitute for it. Otherwise, how would he understand the operating problems of pilots and ground forces sufficiently well to direct them?

There's a booklet put out by the CAB, in Washington called "Civil Aeronautics in the United States" that will give you a good picture of what's required. You also can get definite and precise information as to responsibilities and requirements for all types of flight and ground operations from the air commerce regulations.

In this connection, we'd like to explain this readers' letter thing again. We do not answer any letters directly. We do, however, condense answering them in this column. We want you to write us about your problems. If you don't do that, we can't help you, because we won't know what you want to know. You may never get a direct answer to your letter, but you will be answered in the column. Incidentally, we read every letter you write us and give it our best consideration.

* * *

J. E. B., South Williamsport, Pa. We never advise a man to leave a good job, but some men disregard this advice and get away with it. You apparently have experience in engine testing, which should qualify you to apply for an instructor's job in the same field. You're an experienced man and apparently are fully cognizant of exactly what you can and can't do. If you are dissatisfied with your present job and want to make a change, then you must make up your own mind whether or not you think it's a good gamble to do so and whether it's worth risking what you stand to lose. If, by cautious and well-presented correspondence to authoritative sources, you can determine that the possibilities of bettering your position are good or excellent, take the leap. But never forget that there is risk involved.

* * *

We know of one youngster, not more than ordinarily well equipped with specific qualifications, who had such faith in his own ability to get a job in aviation manufacture that he took a leave of absence from a fairly good job in the middle west, pocketed his vacation money (after leaving enough to take care of his wife and youngster for a period of several weeks), hitch-hiked his way to California — arriving with carefully hoarded $2.50—and got by with it. He bet his vacation time and money against the chance of gaining it back later in increased earning capacity. He won and now is doing far better than he would have if he'd played safe and stayed in his old job. He could just as easily have hit home again without having any of the fishing or lying on the beach his money otherwise would have bought him. We don't think he would have yelped about it if his gamble had gone haywire. He'd have gone back to his job at home, and figured that anyway he'd tried.

This particular kid, incidentally, now has an extremely responsible job, a lot of overtime piling up, another baby in his family and confidence in his future.

* * *

Again, anent this business of taking pains to know how to do well what you do. A recent encounter with one of our readers was amusing, and perhaps worth repeating. This fellow had just arrived on the Pacific Coast from Iowa. He wore the badge of one of the major aircraft

(*Continued on page 105*)

Ask Yourself These 3 Questions

Have I a High School education?

Do I want a career, rather than just a job?

Am I taking steps to make good?

IF YOUR ANSWER is "yes," the following news may be important to you: Today, more than ever before, trained men are needed in the aviation industry—not only to supply the needs for the present—*but for the future.* In the Boeing School of Aeronautics, serious-minded young men with high school education will receive just the training that is required to fill aviation's growing demands. *Boeing School Grads are wanted now and in the future.*

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2. **It offers 8 career courses—35 subjects.**

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7. **Boeing School men make good! If you have made a good start toward an education, if you are alert and serious, if you want to start places now in aviation, use the coupon below as your first step.**

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Street Address .....

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State ..... *Age* .....

Previous Schooling .....

UNITED AIR LINES

BOEING SCHOOL OF AERONAUTICS A DIVISION OF UNITED AIR LINES

Pilot—Stray Not Into Mexico

(*Continued from page* 31)

minutes and the oil temperature was running between 180° and 190°. I felt no concern at this, as the day was quite warm and we had flown to Yuma at about the same temperature. But when the temperature rose to boiling and kept right on going up to about 250°, I really started to worry. I was about half way to El Paso and over terrain so rough that I couldn't think of making a landing without serious results.

I flew for 10 or 15 minutes more and was about 25 miles from the border. By this time the temperature had boiled out so much oil, the oil pressure had dropped to 15 and was rapidly on its way down. I just couldn't sit there and burn the engine up, knowing it wouldn't be long before something happened anyway, so with the oil pressure somewhere between five and 10 pounds, I very slowly eased the throttle all the way back. The moment the throttle was closed the engine froze tight and all was very, very still.

For a few seconds I deliberated between a dry river wash with its possible unseen ruts and gulleys into a 20-m.p.h. wind, or stretching my glide to a narrow road with high banks on each side running across the wind. I chose the road, figuring I should be able to glide at least a quarter of a mile past a sharp bend onto the straightaway. Fortunately there was no traffic at the time. So, having plenty of straight road ahead of me, I came in at about 90 m.p.h. so as to give myself plenty of control to get lined up with the road and check my drift.

About 10 feet above the road I put the flaps full down and looked straight out the front, more concerned about drift on the narrowest runway I ever expect to use than on a perfect landing. The Stinson plunked on the road and stayed.

As luck would have it, the ship stopped rolling within 50 feet of the only place within miles where it could be pulled off the road. I had no sooner taken care of this when a customs official happened along, who was met by two Mexican fellows out on a Sunday drive. The customs man guarded the ship while the other two Mexican fellows took me on into Juarez and did my talking for me. I had broken another law by landing on a highway and had to start wrangling with the officials all over again.

Now here is where the rub comes in: nine times out of 10, if you are forced down in Mexico you are going to need equipment and possibly mechanics—and getting them through Mexican customs is no picnic. A few months previously a less-fortunate pilot than I got a wheel in a rut in another dry lake, tore his gear loose and broke his prop. He was detained several weeks in all and fined 500 pesos to top it off.

The two Mexican fellows, one of whom spoke English, took me to the man next in charge to the customs chief. (I had told them to take me to the American Consulate, but evidently they misunderstood me.) I told him I wanted to go to the El Paso airport for materials and, after a seeming interminable argument, he let me go, agreeing to meet me at the immigration office at the bridge on my way back from the airport. After hiring a taxi, going to the airport, obtaining my supplies and coming back to the bridge, I had another long argument. They wanted me to spend my money on a Mexican taxi and, upon my refusal, three of them piled into our taxi and went along for the ride.

On the way to the ship I was lucky enough to intercept the bus and pick up my two friends. We tried to start to work on the engine but a grand total of five would-be officials stood closely around, telling us to get started so they could see us fly. We finally convinced them that there was no use of their waiting as it would take some time to get started. When they did start to leave, they asked for a tip for *their* trouble.

This will give you an idea of the efficiency in my new air foil!

After having restrained myself by very slowly counting to 10, I politely told them we just couldn't afford it. It might be well to remark at this time that it is most important to be polite and diplomatic at all times, no matter how provoking the situation. I'm quite sure that realizing this from the start saved us considerable additional trouble. By this I don't mean to imply that the high officials are provoking, because they are not. They are particular, but most courteous.

We worked until dusk and couldn't get the ship to turn up enough r.p.m. We were preparing to sleep in the ship that night and get mechanics in the morning, when we met the American vice-consul, who had just driven up, for the first time. I hope that you never will have to accept his hospitality, but if you do you will not find a finer, more cooperative friend than George Henderson, the American vice-consul who handles these cases. He went out of his way many times to be of assistance to us.

From then on we were in expert hands through our troubles. He appointed a military guard to stay with the ship that night and took us to town. The following morning we decided to consult mechanics at the airport in El Paso to determine what was the best thing to do. Mr. Henderson told us to phone him when we got our mechanics and he would see about a special permit for them. Mechanics are somewhat wary (and justly so) about going below the border. There are so many angles that can be brought into play to detain them.

After getting the mechanics we went to the consulate office and got Mr. Henderson. He took us to the Mexican immigration chief and introduced us. After a 10-minute chat with him we had as a special favor a 48-hour pass to go and come as we pleased. He then gave us a note to take to the garrison, asking for us a military escort. After a short delay at the garrison we got our escort.

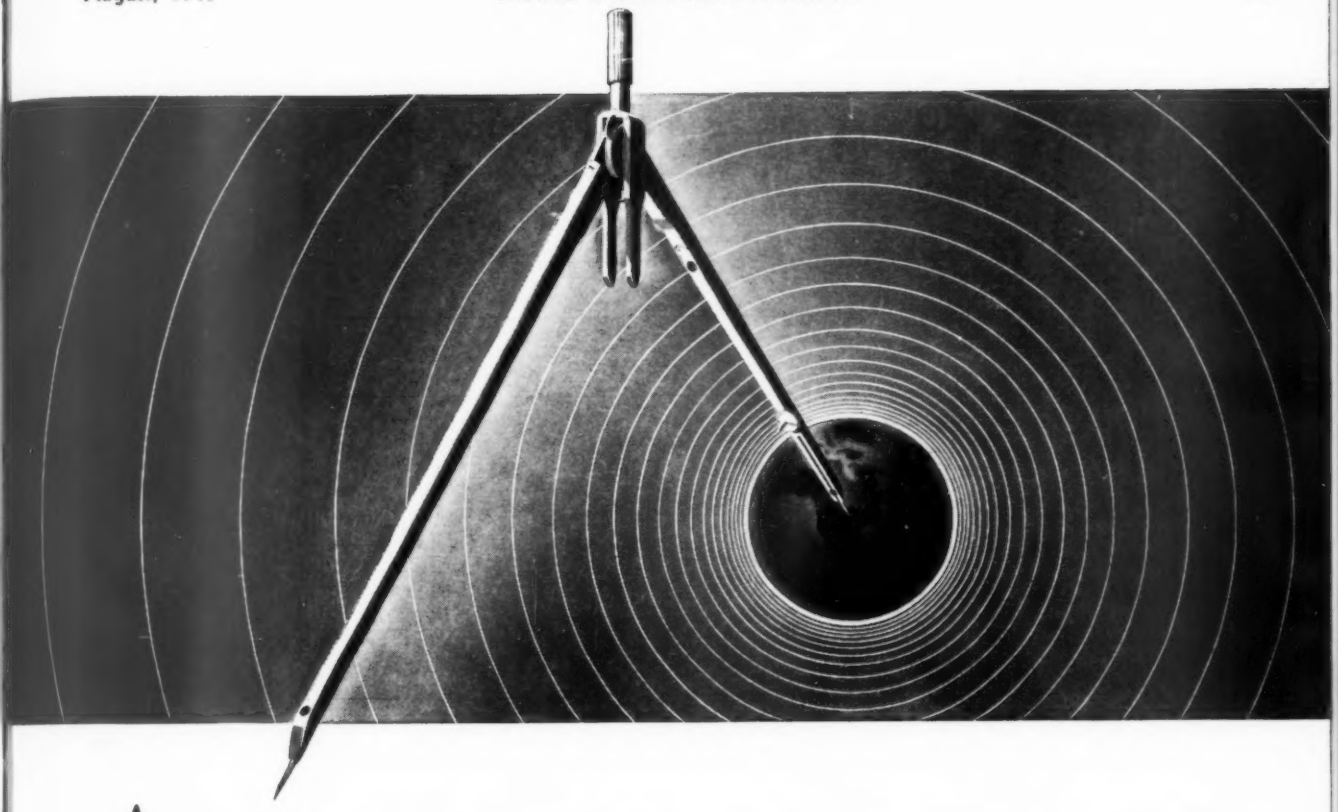
We then drove down to the ship and first decided it was too much in the open and so thought it best to tow it 12 miles down the road to the comparative shelter of a small village near Juarez. We had just reached the village when two federal police officers drove up in a patrol wagon with the full intention of taking us into town, when they noticed our military escort. After a lengthy talk they drove back.

By this time dusk had arrived again and we went back to town, leaving the military guard with the ship, deciding that the following morning we would try to get it to run well enough to fly across. The mechanic told us that there were too many things that could be wrong to know without getting into the engine. We had no facilities at all and there was dust blowing around all the time.

We deliberated dismantling the ship, but that involved many difficulties, including more red tape through customs and probable damage to the ship. So after another troubled night's sleep, we decided that flying it across the border was the only thing to do.

When crossing the border again the following morning with a mechanic, we showed the pass to a strange officer at the bridge. He, as did every strange official we encountered. had to dig up the whole story for himself.

We then drove down to the ship and ran the engine a few minutes on very thin oil, then drained it off for possible metal fragments. We then cleaned all of the plugs, put in heavy oil and 87 octane gas and started the engine. It would turn just 2,000 r.p.m. on three cylinders. We ran the engine for about 15 minutes and had normal oil pressure and temperature, so decided it was then or never.



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We towed the ship back up the road a couple of miles to a straight stretch and Mr. Henderson stopped the automobile traffic. I got lined up, opened the throttle and brought the tail up quickly to see more clearly where I was going. By the time I got into the air at about 65 or 70 m.p.h.—not enough speed to do anything but fly straight ahead—a cut in a hill for the road was just about to be cleared when some very turbulent air from this cut threw the ship up on its side and seemed to suck it down. There was barely room for the wing spread in level flight at this point, so it was necessary to hold my position by crossing controls and flying through the cut on about a 45° angle.

Ignoring a very chilly feeling for such a hot day, I then concentrated on the El Paso airport, a bare 10 miles distant, but oh! how far it seemed! The ship mushed along at about 70 m.p.h. with a billowy smoke screen pouring out the exhaust from that one useless cylinder, and gained a maximum altitude of only 200 feet over about as rough a chunk of geography as was ever thrown together. Then, after the longest 10 minutes I ever expect to spend, the wheels once more kissed good old American soil.

The worry being over, Tom and Joe then went on east to continue their vacations and I spent a most enjoyable two weeks at El Paso airport with as friendly and cooperative a bunch of fellows as I ever expect to know.

After discovering it would be impossible to repair the engine at El Paso, we dismounted it and expressed it to Pacific Airmotive Corporation in Burbank, Calif., to be rebuilt. Two weeks later the engine was expressed back to El Paso and installed.

I flew the ship locally for two hours and all seemed to be well, but about 100 miles out, after taking off for home on the morning of July 30, the magnetos soured. Evidently the heat to which they had been subjected previously had broken them down and was just beginning to show. We were slowly losing altitude, but squeezed into Lordsburg, N. M., with less than 1,000 feet left. I then telephoned to El Paso and had the mechanics who had installed the engine come down. They traced the difficulty to the magneto points and corrected the trouble. The engine ran perfectly and we flew it locally for half an hour.

The following morning I again took off, but was forced down at Willcox, Ariz., due to magneto coil trouble. I then phoned the home airport for new magnetos. They were flown out the same day and installed and, at about 8 a. m. the following morning, we took off for an uneventful trip home, stopping in Tucson and Yuma for gas and arriving in Los Angeles at about 3 p. m. the same afternoon.

In writing this article I know that I'm leaving myself wide open for criticism, but if taken in the spirit in which it is given, it should prove to many pilots a good example of what not to do. When I started writing this article, Mr. Henderson advised that I point out the fact that, although my case set a precedent on cutting down red tape, I still was extremely fortunate. He cited several less fortunate cases of pilots who had wandered off their courses into Mexico. And to appease my much abused ego I must say it is darned easy to do.

END

Plant Planner

(*Continued from page* 41)

to take the plane all the way from fuselage priming through assembly.

"What gripes me is that the model isn't finished," Meloy explains, pointing to a portion of the building that he wants to paint red. "After all, it at least ought to look like brickwork. And offices ought to be added out here. Then there's the matter of the J-3 paint shop—"

In other words, although everybody else admits that the "Toy Shop" has grown up and proved its worth, Meloy, like any other parent, thinks there's still some growing up to be done.

"But," he adds, patting the un-bricked side of the model, "I'm proud of it."

END

New Heart Test

AVIATION medicine's latest instrument for pilot testing is a device to check the effects of flying on the heart. It records human heart beats' sound waves at the same time it records the electrocardiogram, or picture of the electrical changes as the heart muscle contracts and expands during the heart beat. A WPA research project, organized in cooperation with the CAA, is studying and evaluating the heart sound records so that a scale, or set of standards, of heart sound records can be set up.

Airline Test Pilot

(*Continued from page* 17)

calls. Since ceiling and visibility are unlimited we get a routine clearance.

"Tower to TWA 357. Your clearance: TWA 357 is cleared from Kansas City to northeast leg of range, to cruise above 6,000 feet."

When head temperatures reach 300° and oil temperature is at 140°, Bob pulls the propeller pitch controls back into full high pitch to check operation of propeller governor, then pushes controls to the forward position and, when the propellers have reached low pitch, opens up each throttle.

Before take-off on a scheduled flight the engines are run up to 30 inches of manifold pressure only, but on a test flight the engines also are run momentarily at 45.5 inches to insure satisfactory operation at much lower horsepower. Bob gives me a nod. We're ready to go.

"TWA test No. 357 to Kansas City tower. Ready to take off."

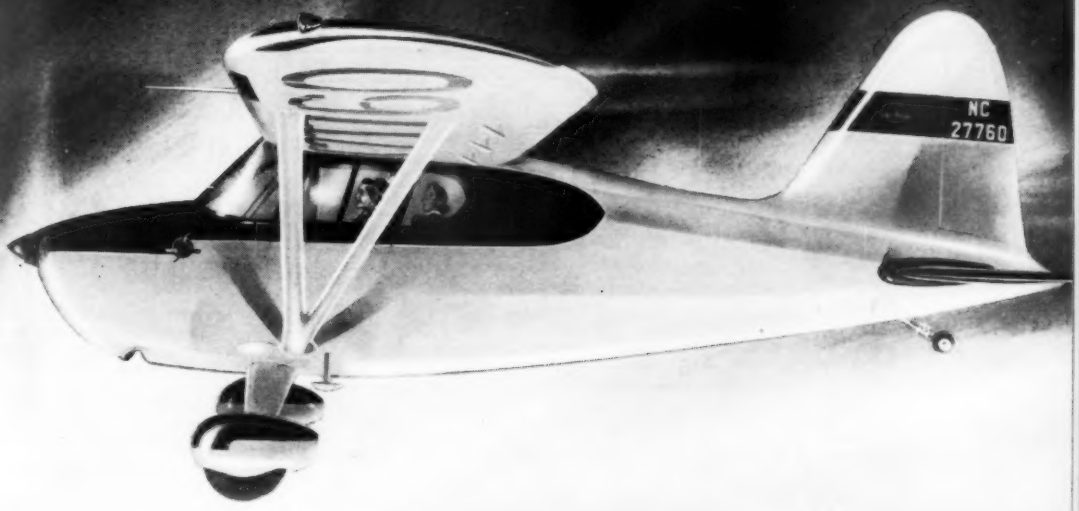
"Tower to TWA 357. Clear for take-off. Several small ships northwest of the field. Okay for a right turn after take-off."

It's a little after 8:30 a.m. when the ship

(*Continued on page* 80)

THE NEW 90 H.P. Stinson Voyager

IS CREATING PILOTS FOR NATIONAL DEFENSE.



PLAYING a responsible part in the success of the Government civilian pilot training program—in helping to create a nation of flyers—the new Stinson Voyager has taken an important place in the program of national defense. In addition to the Government program, thousands of other citizens at their own expense, are training to fly in Stinson planes. These flyers are creating a pilot reserve which is forming a lifeline in our national defense. Ideal for its part in this great program, the Stinson plane provides an unequaled safety record and such modern features as flaps, slots, hydraulic brakes, electric starter and generator and other developments found in advanced bombers and fighters. For training in cross-country flying and navigation Stinson provides sturdy construction and roominess. In every way the Stinson Voyager is built to take its part in constructing this vital link in our program of preparedness.

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is turned, headed north, tail wheel locked and Bob slowly pushes the throttles forward until 45.5 inches of manifold pressure and 2,500 r.p.m. is reached. Since the ship is lightly loaded and because each engine has 100 h.p. more than the old G-102, we get flying speed very rapidly and take off with a rush.

Bob calls: "Up gear." I unlock the safety latch and pull the landing gear lever to the "up" position, then take my mike off the hook and press the button.

"TWA 357 to Kansas City tower. Off at 32, three two, and changing over."

Tower answers, "TWA 357 off at 32, three two, okay to change to company frequency."

I change to our frequency and give our time off the ground. We are at 1,000 feet in a gentle climb to the right. Now I turn and see that the inspector in the passageway behind the cockpits has our test flight report sheet clipped to a pad and is busy writing down engine take-off and climb performance data. Under left engine take-off r.p.m. he writes 2,520, and 2,500 r.p.m. under right engine. This will require a minor adjustment to insure the left engine turning up only 2,500 r.p.m. on take-off.

Now we're heading due east at 4,000 feet, flying down a section line to check the compass. Since the local variation is 8° east and the compass reads 82°, our inspector makes a note on his sheet. In a similar manner during the climb to the critical altitude (altitude at which rated power is obtained with wide open throttle) the compass is checked on north, west and south headings. On the west heading it is off slightly, but reads exactly 352° on a north heading and 172° on a heading south.

As we continue to climb the inspector writes on his pad: Altitude, 6,000 feet; oil temperature, 155° right, 160° left engine; left head temperature, 380°, right, 370°; fuel pressure, 15 pounds; outside air temperature, 50°.

Now we're at our critical altitude of 6,900 feet and ready to begin Group No. 2 of the test flight report (this new G-202A report was designed by Loomis). Bob pushes the wheel forward to level off. I reach down and push the mixture controls forward into the cruising lean position. The engines' r.p.m. is reduced to 1,900, with throttle setting to give 27.5 inches of manifold pressure. Group 2 is: "Carburetor mixture check and cruising power test at critical altitude (6,900) both engines."

Bob moves the carburetor heat controls one at a time to the "full on" position. The slight manifold pressure loss for each engine is noted and a complete record again is made of all engine instrument readings.

Twenty minutes after take-off from Kansas Citv, TWA calls "Kansas City to test No. 357. What is your position?"

"Three fifty-seven to Kansas City. Over Missouri City at 6,900 feet."

"Kansas City to 357. Okay. TWA flight 10 was off the ground at 46, four six. Climbing to 9,000."

"Three fifty-seven to Kansas City. Okay on traffic. First Officer."

I lay down the microphone and see Bob open the left throttle wide and increase the r.p.m. of the left engine to 2,300. He's preparing to "feather" the right propeller. Back comes the right throttle and prop pitch control until manifold pressure reads 10 and in full high pitch the r.p.m. is at 1,300. Okay.

Now Bob lifts his arm to the panel over my head, pushes a red button labeled "push to feather." I glance out of my window, see the propeller slow until it is barely moving, then suddenly stop. Bob turns his head to our inspector. "Seven seconds to feather." Then a check is made of the time necessary for the left prop to feather. In each case I note that our altimeter steadily reads 6,900 feet with one engine dead, although Bob says we could climb 400 feet per minute on either engine. Purpose of the feather test, of course, is to be certain that the running engine will develop rated power at critical altitude and to make sure the feathering mechanism is working normally.

As Bob adjusts throttles and prop pitch controls back to normal cruising power and prepares for Test Group No. 4 I see our flight 10, still climbing, pass a half-mile east.

Flight and engine instruments are checked in Group 4. First, to test the turn and bank indicator, the ship is put into a normal one needle width turn to the left, held for 90° and rolled out. Since a complete 360° turn should take two minutes, our time should be near 30 seconds. I glance back and see Inspector Brown write "30 seconds,"—right on the dot, as is a 90° turn to the right. In quick succession the directional gyro, automatic-pilot horizon, artificial horizon, rate of climb indicator, propeller synchronizer and wing and tail leading edge de-icers are tested.

Suddenly Bob rolls into a vertical right bank, pulls the control wheel back sharply, rolls out and dives. Back comes the wheel. No, it's not a 9-G pull-out. Bob is on Group No. 5, the test of plane controls and stability. No. 357 responds normally.

Inspector Brown asks me to check the radio. No. 357 was dispatched from Kansas City on TWA frequency of west day. Since the radio is working normally on that frequency, I reach overhead, turn the selector switch to east day frequency and pick up my mike. "Three five seven to Kansas City on east day. How is it?"

"Kansas City to 357," Kansas City replies. "Transmission normal on east day. Check east night." Each of the TWA frequencies is similarly checked.

The inspector leans down near the cargo loading door, listens a moment. "Small air leak in forward loading door," he writes, then ducks his head and goes back into the passenger compartment to check for air leaks or rattles in the main cabin door, cabin windows and cabin chairs. Nothing is as annoying to passengers who want to sleep, or carry on conversation in a normal tone, as a shrill whistle or loud rattle just as they say, "Well, personally I think the Giants' chances this year are . . ."

Bob slows the ship to 140 m.p.h., turns and says, "Down gear." I push the gear handle to the "down" position, wait until

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the landing gear pressure gauge reads 750 pounds, return the lever to neutral and snap down the floor safety lock. Our landing gear has extended normally and I report, "Gear down and locked, pressure 750, green light is on."

No. 357 then is slowed to 110 m.p.h. for a test of flap operation. "Down flaps full," Bob says. The flap handle lever is pushed toward the floor, then returned to neutral when the white indicator button directly in front of the captain's seat has swung over to the position at the extreme right.

"Flaps are down full."

The ship is put into a normal glide at 90 m.p.h., head and oil temperatures are checked to be sure the engines do not cool too quickly. When Bob is satisfied that plane control and stability are normal he commands, "Up flaps five degrees at a time." In order not to lose an excessive amount of lift by raising flaps suddenly, they are raised in easy stages; then, on command, I raise the landing gear.

The test is complete. Bob turns No. 357 to a 232° course toward Kansas City, says, "Okay, Mac, will you contact the company, give our position and change over to the tower?"

As I check our position the fan marker indicator light on the captain's side begins to flash. I press the mike button and speak into the phone:

"Three fifty-seven to Kansas City. Just coming up on Excelsior Springs, 6,500 contact and changing over. First Officer."

Kansas City replies: "Kansas City to three five seven. Excelsior Springs at 6,500. Altimeter, 2,998, two nine nine eight. Okay to change over. Tower on west night."

I shift to west night: "TWA test 357 to Kansas City tower. Just passed Excelsior Springs at 6,500. How is it?"

"Tower to 357. Okay on your position. The wind east northeast four. Traffic landing northeast. You are cleared to the field."

Bob makes a standard approach, we come on in and land. We taxi back past the loading ramp at the terminal and up to the hangars. The ship is wheeled to the left, Bob locks the tail wheel and cuts the ignition. "Okay, Mac, that's it. Let's go talk to the crew chief." He takes the test report Inspector Brown gives him. We get out of the ship and go into the hangar. Bob makes several notations on the back of the report, returns it to Brown. "How soon can you have the ship ready?"

Brown checks the report, figures a moment before answering. "We'll have it ready to go on Flight 20 at 12:30 this afternoon."

There you have it. The job of an airline test pilot. It's the highly necessary step-by-step check of every company airplane, on the ground and in the air. And, though the passengers know little about it, it's a very real safety factor in airline operations.

END

Good Ship Emmanuel

(*Continued from page 52*)

been any difficulty in spotting the bed sheets used for markers and only the one field has proved unsuitable.

There are usually overflow crowds at the service. It can not be claimed that the novelty of a flying minister has not attracted many people to the services. The ship is equipped with a public address system which enables the service to be heard by the overflow crowd outside. The service generally includes a morning sermon at 11 o'clock, basket dinner at noon and afternoon service; occasionally the party is detained so that the return is made after dark. It also is possible to hold a morning service in one community, an afternoon service in another and an evening service in still another, should the occasion for such mobility arise.

These trips average around 500 miles weekly in the air, or five or six hours at the cruising speed of 90 m.p.h. *The Good Ship Emmanuel* hasn't run into any difficulties yet, consequently it is still being operated on the average of $1 per hour for gasoline and oil and the estimated $1 per hour for mechanical upkeep and depreciation. That comes to an actual expenditure cheaper than the possible minimum of about 2½c per mile for operating a car, to say nothing of the time saved. Naturally, the $1 for upkeep and depreciation is in the form of savings now; possibly $75 of it is piled up against general expense or any future major repairs. *The Good Ship Emmanuel* has been kept well within its budget, has increased interest in religious matters over a wide area as well as increasing interest in aviation and has saved a whole lot of the progressive minister's time.

END

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Aug. 17-18	Sheldon Air Show, Sheldon, Ia. Sponsored by Sheldon Aeronautics Club.

CONTESTS

June 28-July 13	Twelfth National Soaring Contest, Elmira, N. Y.
Aug. 25-Sept. 2	Third Annual American Soaring Contest, Joliet, Ill.

FLIGHTS

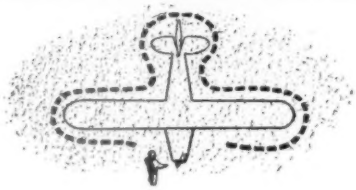
July 12	AOPA week-end flight to Grand Hotel, Mackinac Island, Mich., by reservation only. Ships will land on the mainland at the new Pelston, Mich., airport. Transportation to hotel arranged.*
July 13	Dawn Patrol assembles at Sky Haven Airport, Northfield, O.*
July 13	Dawn Patrol assembles at Ionia, Mich.; Ionia County Airport, for Annual Pilots' Roundup.*
July 20	Dawn Patrol assembles at Mansfield, O.*
July 20	Dawn Patrol assembles at Bay City Airport, Bay City, Mich.*
July 27	Dawn Patrol assembles at Pontiac Airport, Pontiac, Mich., for meeting of Pontiac Chapter, NAA.*
Aug. 3	Dawn Patrol assembles at Alliance, O.*
Aug. 17	Dawn Patrol assembles at Sandusky, O.*
Aug. 17	Second annual AOPA breakfast flight to Red Bank, N. J., Sweepstakes Regatta.*
Aug. 31	Dawn Patrol assembles at New Philadelphia, O.*

MEETINGS

Aug. 29-31	Aero Medical Association, 13th annual meeting, Boston, Mass.

* AOPA flight.

ONCE AROUND THE *Plane*



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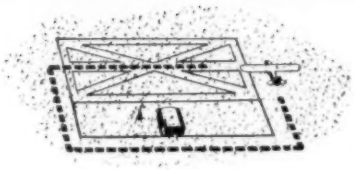

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Luftwaffe

(*Continued from page 15*)

most always. I have seen both Luftwaffe and RAF flyers in training and favor the RAF at tremendous odds. The German youth is given an early training but not so thorough as the RAF lad. He has less hours in the air when he goes into combat and, more or less, leans on his squadron members and his group training.

I have seen huge flights of German war machines wheel high up in European skies. But these large masses of planes failed to impress me as much as one daring RAF boy, fairly tearing his plane to pieces as he pursued his training programs. Foreshadowing what was to come, I once saw approximately 300 German planes blot out the sun for a minute as they flew over Austria. It impressed me then but I am happy today to know that the same number have been routed by fewer RAF planes.

For all their inferiority, the Germans can teach the world something about aircraft and flying personnel. Having received my own flight training in Europe, I am familiar with the German technique. I approve of the training of boys—small boys—and urge America to follow the German example by more encouragement of youth in aviation; by having the Government provide training for boys younger than the college men and women now being trained.

I approve thoroughly of using small, light planes like *Cubs*, Aeroncas, Taylorcrafts and the like in primary training but would advise this country to go one step further; follow the German idea of training boys on gliders. Always a devotee of soaring and gliding, my interest is high in that field, both as a sport and as a training measure.

By starting youngsters on primary or secondary type gliders, the U. S. could educate its youth faster and for much less money. Twice as many youths could be trained. It is only natural that the small plane follows the glider, the heavy craft follow the little ship.

One of the most important factors of a glider education is the meteorology the pilot learns. I think one reason the German forces are so successful is because the Germans have put much emphasis on weather flying. The Luftwaffe pilots are better acquainted with winds and clouds and other weather elements than are their enemies. They know how to take advantage of each little current, each cloud formation and each form of precipitation. However, it is true the English are learning fast . . . as all the world cheers them on.

With the increasing aid to England being given by the U. S., the Luftwaffe's life grows shorter and shorter. Unfortunately, I am not permitted to see as much of American aviation as I would like. As a visiting alien it is hard for me to get close-up views of the aircraft industry here. To ask questions is to lead myself into trouble. I depend on American magazines like FLYING AND POPULAR AVIATION for my news of United States' progress.

I would like to point out, however, that American flyers are quick to understand my interest. They do not, as do some non-pilots, immediately suspect me of being a foreign spy. They accept me as a brother pilot.

Beside all the major factors which will soon lead to a German defeat—more disgraceful than their last—are all the *little* things typical of the Germans. For instance, clothing. I know the value of keeping warmly clad while flying. The Germans do not, to my knowledge, serve their flyers with as good clothing as the RAF. The Luftwaffe flying jackets I have seen are thin compared to the thick leather and fur-lined suits worn by the English pilots.

Experience taught me the value of warm flying togs. I learned to fly in 1928 on a Henriot, known in Spain as a "bird cage" because of its elaborate wire rigging. Gradually I progressed to the English Avro, then to Martins, finally Blackburns which were then used for torpedo carrying.

As a civilian observer attached to the Spanish navy's air arm, I had an opportunity to fly many types of military machines. I flew French, German, Italian and other European-made craft. Then I began to learn their faults. The Italian Macchi flying boats, for instance, had the nasty habit of shedding their motor mounts on hard landings so the pusher-engine would drop forward on the pilot's neck and back.

After my flying service, during which I instructed in Spain, I began to fly the various English DeHavilland *Moths* and owned several. This particular winter day I was flying from London to Paris, en route to Spain. I was in the south of France and despite its latitude, it was extremely cold. I was wearing thin clothing.

My reflexes were affected considerably and I had difficulty in keeping co-ordination as the ship bounced around in rough air. Over the town of Dijon my engine suddenly sputtered and went dead. I was but a few miles from an airdrome but had no chance of reaching it with my motor dead. So I hastily looked for an emergency field. I found only one.

Shivering, I headed for it, side-slipping desperately as the cold wind whipped into the open cockpit. I was so cold I could hardly move. Just as I was about to set my plane down, I saw a peasant riding a bicycle across the field. I knew I would hit him because he did not give any sign of hearing me. Trying to dodge the man, I piled my plane up in a ditch which I normally could have avoided. But my hands and feet were so cold I could not make the proper moves at the proper times.

It has been interesting to me to note the way the Germans have systematically established bases just outside of each country they have swallowed. While flying cross-country in private planes, I often saw German planes scouting the country but thought nothing of it at the time. I know now they were mapping, planning for these days. The ease with which one can fly from one country to the next, bomb and kill and flee home to bases, will never be accomplished anywhere but in Europe. Germans would have a difficult time of running rampant through America as they have in Europe, simply because of the vastness of this land. And because they are definitely inferior to American flyers.

The bases I saw established are playing a very important part in the German conquest. Again I advise America to follow more rapidly some part of that German technique. The taking over of Greenland recently was one of the wisest moves America has made, I believe. I now hope to see the same procedure repeated in South and Central Americas where real danger lies. The establishing of Caribbean bases, too, was a wise move on America's part. By organizing air bases in the south through friendly pacts

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with the landowners, such as the recent Mexican transaction, mutual protection can be afforded the little countries and this country.

There is no real danger to the east immediately, I feel. The only commendation I can make of the Japanese is that they were wise enough to have some pilots trained in England in earlier days.

While the Germans are reported to be turning out huge numbers of planes in mass production system, I am inclined to discount much of those reports. If the planes are really rolling out as fast as Dr. Goebbels would have you believe, be certain something is lost in the making of them. They are almost sure to fail to measure up to English and American planes. However, again I point begrudgingly to the Germans and plead with America to hasten its production. I am acquainted well enough with modern air war to know, or at least suspect, that we who are fighting Nazism are perhaps concentrating a little *too* hard on mechanical superiority.

I would not like to see any reduction in quality in fighting craft built here and in England, but I would like to see smaller, lighter and faster planes built. There is, I believe, entirely too much concentration on big ships. From the bases I have already mentioned it would be possible to operate small, fast planes with more success than the few large bombers which are now operating.

Light bombers like the splendid Lockheeds I have seen en route to England appear to be more valuable in my opinion than the tremendously large and tremendously expensive planes. This is a war of speed, not only in the air and on land and on the sea but in production. The Luftwaffe had a head start on the world and we must now catch up. We can do so by turning out the smaller ships. I am immensely interested in the development of plastics and hope we enemies of barbarism may find our answer there.

Another interesting and important inferiority of the German fliers is the psychological angle. With regimentation drilled into him from the time of his birth, he does not consider himself an individual. On the contrary, the German flier considers himself merely a cog in the wheel of the big state machine. He does not value his life as much as the person's whom he opposes. He is ready to die an allegedly glorious death for National Socialism and Hitler. In that kind of a psychological make-up, that certain spark born of real freedom is lacking. It detracts from fighting character. Is it not true that the man fighting to defend his home, his loved ones, his country, puts forward a more valiant and more fierce battle than the attacker?

Witness the Finns against the Communists, the Greeks against the Italians and my own countrymen who fell fighting in the streets before the invaders. The German pilot lacks the true individualistic fighting heart and breaks first in the dogfight when it becomes man-to-man. Eventually it will cost the Luftwaffe the victory of which it dreams.

END

Groundling

(*Continued from page* 23)

ever left the ground. Crowell knew, though he didn't talk about it much, that he could cut flight time drastically in the earlier stages of instruction. Trouble was that by using his machine a man—or woman—could learn to fly too cheaply. The machine cost almost nothing to operate and maintain and but little to buy. You might consider that a virtue, but Crowell didn't. He knew that flight instructors were too short-sighted to favor any invention that would mean less airplane rentals to them. So he kept the ground trainer a secret, waiting until there would be a demand for it.

If he had any doubts about it when he came to New York in 1940, the Link people quickly demolished them. They referred him to the J. V. W. Corporation of Newark, N. J., the company which distributes Link Trainers and other instruments and administers the Casey Jones Schools of Aeronautics.

"Take this trainer to the Academy of Aeronautics in New York," they told him. "You have *carte blanche* to use the machinery and the instructors. All our resources for preparation and research are open to you. Work all the bugs out of it. But hurry!"

Crowell did. He developed a primary ground trainer that weighs only 350 pounds and can be set up and broken down in a trice, making it portable. It works on the simplest principles Crowell could build into it. Best of all, it sells for only $250. Men and women pilots who have tested the trainer say it feels and reacts like an airplane. All sorts of persons have tried to buy trainers to have them installed in their cellars for fun. It takes up only one square yard of space. One man wanted to buy the rights to the machine and set them up in amusement palaces to sell rides for a quarter a throw. But Crowell takes his aviation seriously. He said "no," quietly and emphatically.

The Crowell trainer looks like a pilot's seat in a transport plane, set on a cast iron half-sphere. In front of the seat is an instrument panel, with only a compass installed. The control stick and the rudder pedals are integrated with a metal shielding which encircles the seat to prevent the mechanism from tipping over as the seat banks or points up or down. Manipulation of the controls moves the seat to approximate the action of an airplane as it rolls in any direction on the rounded base. To give the trainer change of direction, a small propeller that looks like an electric fan pulls the seat from side to side in accordance with the handling of the controls. Attached to the instrument panel's front is an electric light, with a projector which throws its beam onto a screen set about 10 feet before the trainer. The screen has a lateral figure eight criss-crossing it and a perpendicular line crossed by a horizontal. The problem is to follow those lines with the light as the controls are handled.

Only two principles are used: balancing, by shifting weight of the controls; and use of an airscrew, to change direction. The trim of the airplane can be varied by means of a wheel control at the back of the seat. A seat belt is worn when using the trainer, "to train students," Crowell says, "in the proper habits".

"Habit is a funny thing", he continued. "I've noticed since having the trainer on display at the Museum of Science and Industry that almost everybody uses the left foot to turn right and the right foot to turn left. That's because we learn as children to do it that way. On velocipedes, sleds, outboard motors, wagons and skiis, one pushes from the opposite side to make a turn. The natural reaction when getting into a plane or a trainer is to follow that ingrown instinct."

Under Crowell's supervision, tests were run that prove at least 25 per cent of primary flight training time can be saved by use of the trainer. It can do almost

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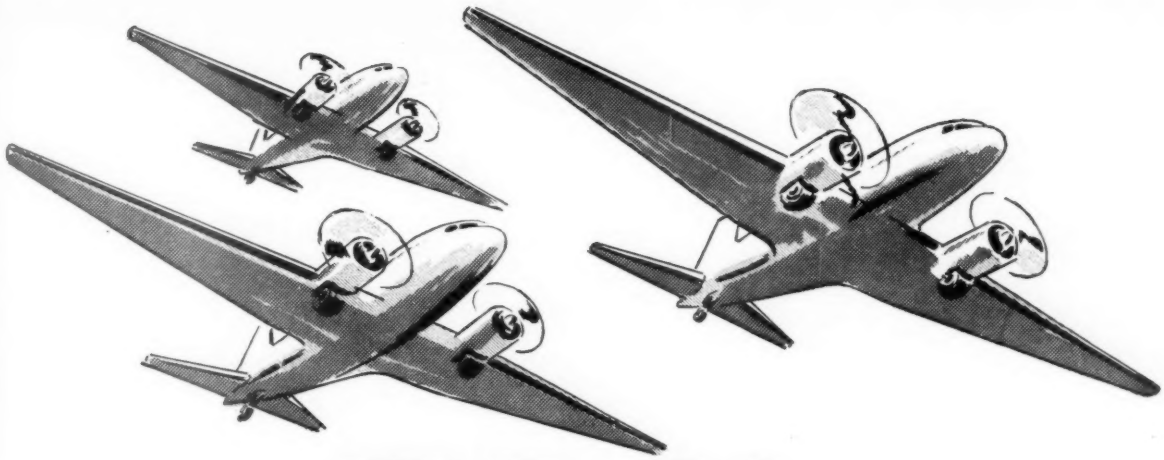

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anything that an airplane in normal flight will. With it one can demonstrate a bank with turn coordination in actual use of rudder. Like a plane, it loses lift at the beginning of a turn by rotation of the propeller at the front of the seat. A stall is demonstrated by putting the trainer into a climb and cutting the switch. It will closely simulate a spin, but that is not advocated for training by Crowell. It banks to a maximum 30°. By following the lines on the screen in front of the trainer, the user can perform any normal flight maneuver and know immediately how accurate he is by the location of the light in relation to the lines marked on the screen.

"We don't claim we can teach people to fly with the trainer", he says. "But we prepare them so they can learn to fly easier and more safely."

"At present we're wasting planes by using them for primary training. By saving 25 per cent of primary flight time, you in effect add 25 per cent of planes for training. That means the operator with four planes used in instruction work can get one of these trainers and have the equivalent of five planes."

Unlike ordinary planes, the trainer is available for practice at all times. Weather and darkness become unimportant, because even a practiced student can use the trainer for precision turns, figure eights, and level flight. The electricity used is approximately the same as that consumed by a large floor lamp

Of the first trainers produced, one went to the Army for experimental purposes, one to the Boeing School of Aeronautics and one to Parks Air College. At the University of Michigan, instructors tested the Crowell trainer by giving five students four hours' training each on it before putting them in airplanes for their first flights. Instructors were able to predict accurately how well the students would progress on flying equipment. They said the trainer enabled the students to make "remarkable progress" in their actual air work. On his solo flight one of the young men made two take-offs and a landing without giving grounds for criticism.

The dealers are not limiting their market. They expect to sell many trainers not only to operators and aviation schools, but to high schools and colleges. There aeronautical course students, members of aviation clubs and anybody else interested in learning to fly can be given the feel of an airplane. They can learn coordination, concentration and accuracy and will know how to fly an airplane before ever being in one. The J. V. W. Corporation expects to sell 10,000 trainers during 1941. They are made at the Link factory in Binghamton, N. Y.

Many instructors have complained that the universal use of the Crowell trainer will cut into their business. "That, of course, is erroneous," Crowell says, "The trainer will not hurt their business, but will help it. It will create new customers by demonstrating the ease of flying. Time on the trainer is inexpensive because cost of operation and of maintenance is negligible; therefore, instructors can charge less and more persons can afford flying lessons. It will give them, to all purposes, more airplanes."

Crowell himself is a pilot with 20 years' experience in many branches of commercial flying. He has a mild fame in the south as a "stunt" flyer, which doesn't sit quite right with him. What to spectators appear as stunts are in reality experiments Johnny performs to test his inventions and reflections on obscure phases of his business. He once purchased a Jenny to find the safest way to set a landplane down on water. This was ballyhooed as a "stunt" and people began to think of Crowell as one of those crazy aviators. But his scientific mind had started to work on the question of what to do if an engine ever quit while he was flying over water. He set about finding out in the only practical way there was—to try it. He learned one should land on water exactly as he would on land.

He's a handy man with tools and he carries on an unending crusade for mechanical efficiency. That's how the trainer was born. During the years he instructed students, he saw the need for some sort of ground trainer which would stress accuracy in flying. In a two-seater airplane you can't exercise the supervision over new students that they require. If there were only some way you could teach them in the hangar. . . . He developed the Crowell Trainer. When he finally came to New York, he left Charlotte regretfully. He has been saying every two weeks for eight months now, "Well, I'll be starting home in a couple of weeks." But one thing and another keep him here, at work demonstrating the trainer.

Its first public showing was at the Abercrombie and Fitch aviation show in February. Since then it has been an exhibition at the Museum of Science and Industry, where scores of people daily try their skill at flying. All indications are that the public will welcome this chance to try flying inexpensively. Most important to the industry, however, is the fact that the Crowell Ground Trainer has given them at least a partial answer to the problem of training multitudes of pilots fast. In the national emergency, they say, that's what counts.

END

How Safe . . . ?

(*Continued from page* 36)

Faulty lubrication was responsible for 14 of the crackups studied.

Valve, ring and piston troubles led the list of power plant structural defects attributable to poor maintenance. They caused 18 crashes out of a total of 36 for the division. Specific major difficulties were: valve failed, 12; rings stuck, seized, jammed or broken, six; cooling system—leak, broken line, or no water, four; valve sticking, three; piston seized, three.

"In checking valves it is important to watch for any undue wear or excessive play in the valve guides," warns the report. "If valves are allowed to remain in operation with excessive play in the guides, fatigue failure of the valve stems is likely to result. Guides should be replaced when necessary, by an approved repair station. It is important to have valve clearances correct in order to obtain maximum power and smooth operation. Piston seizure and ring-breakage, or sticking, generally result from poor lubrication or improper cooling."

Here's a hint on starting: "Before starting, especially with radial engines, the propeller should be 'pulled through' with the ignition OFF, in the direction of rotation and, if an unusual pressure is felt, an inspection should be made of the lower cylinders to drain oil that may have accumulated there. Never turn the pro-

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peller backward if an unusual pressure is felt, because this will force oil into the intake pipes and this oil will enter the cylinders after the engine starts. Several engines have been damaged by starting with oil or water in the cylinders."

Five accidents involving propeller maintenance are cited. In two of them the propeller was not secured after being replaced, in two others the spinner flew off and in the final instance the control mechanism failed.

"Before installing the propeller," the Safety Bureau explains, "the shaft should be cleaned thoroughly and a light film of oil should be applied to prevent the propeller hub from seizing to the shaft. The retaining nut and lock nut should be screwed firmly on the shaft and lined up so that the prong steel ring can be safetied on the two nuts. The nuts should be checked again after the engine has been in operation. If the propeller is loose on the shaft, it will cause roughness when operating and may possibly result in a crankshaft failure."

If your ship's propeller is wooden, rub it down and varnish it frequently to prevent dampness entering between the laminations of the wood. Rivets holding the tips should be soldered when necessary by a competent mechanic, care being taken not to disturb the balance or track of the propeller. Duralumin propellers should have all uneven surfaces smoothed down. When a steel propeller is damaged, send it to the factory for balancing, etching and repairing. Controllable-pitch props should be serviced frequently and counterweights cleaned and regreased. A used propeller which has been damaged is a poor buy unless it has been repaired by an expert.

The report lists 59 structural failures, involving landing gear and assembly. Defective welds and faulty brake adjustments each accounted for 14 of these accidents. Analyzing the landing gear crackups, the Bureau explains that "In a large number . . . the actual damage occurred in a preceding flight. For example, landing gear fittings and cross members might have cracked in a previous landing or take-off and gone undetected."

Recommendations call for inspection of landing gear and fittings at frequent intervals. "To do this properly," reports the bulletin, "jack up the plane so that the landing gear is free from the floor. At this time the brakes should be thoroughly inspected, adjusted and all exposed moving parts lubricated. This is important because brakes and wheels are subject to severe usage. Dirt and grit often clog the moving parts." Of the faulty welds the Bureau comments that "either factory inspection or repairs made in the field can be improved considerably."

Think, when tempted to neglect landing gear, that its failure on landing will probably result in costly damage to your ship . . . and that thorough inspections would eliminate many or most of such accidents.

A typical case is that of a plane whose rear diagonal landing gear strut, right side, collapsed following a normal landing and caused the ship to go up on its nose. The break occurred where an old crack apparently had existed for some time. Surprisingly, there was only one instance of retractable wheels failing to function.

Six control accidents, two of which proved fatal, were attributed to poor maintenance. In one instance the left rudder cable broke when a landing was attempted. The plane stalled into a creek, killing a swimmer and seriously injuring another. In another case a passenger was killed and a pilot badly hurt when the "up" elevator cable failed. Longitudinal control lost, the ship dived into the ground. "All inspection plates should be removed and control wires and fittings should be checked to insure against any malfunctioning and undue wear," advises the report. "At the same time spars and ribs should be checked for fractures, dry-rot and grain defects."

Although there were only four wing failure accidents, all but one were serious. Three resulted in a total of six deaths and only one was not marked by a fatality. The Safety Bureau described the fatal crashes as follows:

(1) Wing structure failed upon pulling up from a dive. Investigation revealed that the wood construction of the wing was deteriorated and rotten. Fatal to pilot.

(2) Wing failure occurred during an acrobatic flight because of undiscovered damage incurred in a precious accident. Death to pilot and two passengers.

(3) Entering edge of wing failed . . . the pilot had, during the previous day, put this aircraft through excessive, violent maneuvers. Fatal to pilot and one passenger.

Fabric accidents also were serious. One of the five caused three deaths and one serious injury. It happened when the pilot noted a fuselage fabric failure and started to make a precautionary landing. The plane stalled. In other cases, fabric tore where it had been previously mended. "Fabric should be renewed after several years' service or constant exposure to the elements," the analysis warns. "Repairs should be made carefully, in accordance with accepted good practice. A wrinkle anywhere in the fabric should be regarded with extreme suspicion of structural failure underneath."

Don't tempt fate by refinishing until the dope is holding the fabric together and make slipshod repairs which may fail while you're in the air.

The three remaining accidents in the list were classified as miscellaneous and included an engine cowling coming loose, stabilizer fittings breaking off and a stabilizer adjustment failure due to a previous improper repair job.

By way of comment, the report points out that "careful inspection and maintenance will detect the major enemies of the airplane, which are corrosion, fatigue cracks and wear. Steel fittings, longerons, etc., are natural conductors of moisture, resulting in rust and deterioration. These parts of the plane can be preserved by protective coatings of paints, varnishes, greases and metallic films. To prevent an electrolytic action, dissimilar metals, such as copper alloys and duralumin, should not be allowed to come into contact with one another. Planes should be kept scrupulously clean in order to facilitate the detection of cracks and failures."

How can you avoid maintenance accidents? Summarizing, the Safety Bureau states: "The fundamental principles of aircraft and engine maintenance are relatively simple, especially for the smaller type of plane flown by the private pilot. The first step toward proper maintenance is daily line inspection. These inspections should include a complete check of all parts of the plane and engine, including the propeller, and should be recorded on an appropriate inspection form to prevent neglect of any part. The pilot should familiarize himself thoroughly with the maintenance manuals published by the manufacturers and, if necessary, should employ a mechanic to instruct him in the proper maintenance of equipment. This would inspire confidence in the pilot regarding the proper mechanical function of his equipment, leaving his mind free to concentrate on the flying of his plane. It is particularly important for pilots and owners to comply with the maintenance

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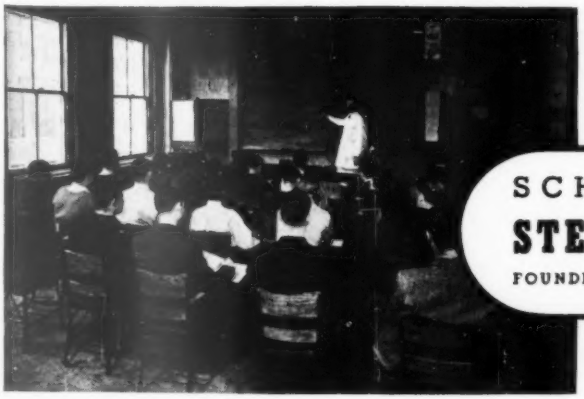

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"It is unfortunate that some of the new pilots will disregard the hints and warnings contained in this survey until they, too, have had an accident and have become a statistic."

END

Problem Pilots

(*Continued from page 38*)

Of course, the instructor has a wider range of ability and is more dependable in unexpected circumstances, but any supervisor of instructors knows that he cannot discover the relative instructing ability of his men by testing their relative piloting ability.

There are other qualties which any instructor must possess even to be passable, such as a reasonably agreeable disposition, a sense of responsibility, comparative tirelessness, patience and determination. But these are obvious necessities. A man may have all of them, plus superb flying ability, and yet be a comparatively poor instructor. Men who are seriously lacking in these qualities seldom get jobs, and usually fail to keep them even if they manage to get them. And yet, among acceptable instructors; among men with enough knowledge, experience, and personal force to influence people in the air, there are still some noticeable differences in ability. Why?

Principally, because an instructor is dealing with men as well as with planes. He must know both and know them well. He may understand airplanes and their behavior with thoroughness in a few years or even months of concentrated study. Human behavior is considerably more complex than airplane behavior, and even the most elementary understanding of it requires much more experience and study.

The talented flying instructor, then, is the man who, in addition to a fair knowledge of flying, also knows and understands men. He is the man who has always taken a serious interest in the people around him, who has consciously or unconsciously studied them and their actions, and so has developed a keen and penetrating insight into human nature. He is the man who has learned to guess *why* people do things as well as to notice *how* they do them.

No one knows better than an experienced check pilot the wide variations in plain human understand that can crop up even in a small group of satisfactory instructors. To some, a man may be either dumb or smart, slow or quick, lazy or industrious, nervy or timid, and that is about all. For most students these classifications, plus a few others, will suffice for all practical purposes. But there are always a few who cannot be pigeon-holed so neatly. There are usually some who act very dumb in the air when the instructor knows from studying them that they really are not dumb at all. Why? There are some who are certainly very anxious to succeed and yet appear very lazy. Why? There are some who appear to be learning rapidly and yet occasionally are the victims of surprising and serious lapses of memory. Why? There are some who show plenty of nerve when the occasion demands but are obviously flying under a serious strain. Why?

The answers to each "Why?" in these complex cases may be simple or they may be something entirely new even to the most experienced instructor. There seems to be no limit to the complexity of human nature. The limitations exist only in our understanding.

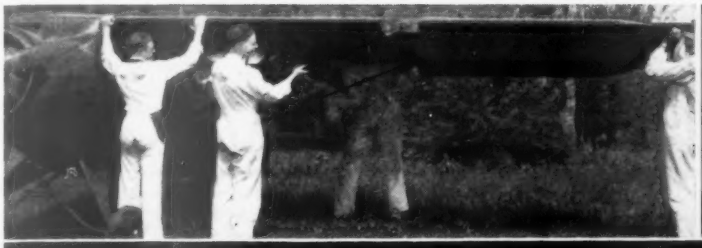
The experienced instructor knows that students fall into certain general types, so that after training a few dozen he can begin to predict their actions and reactions on the basis of his remembering others who were somewhat like them. But there are always—*always*—exceptions. I have seen old-timers who had instructed hundreds shaking their heads in thoughtful bewilderment over some student, the like of whom they had never seen before. No student is so steady and true to form that he will not, some time during his training, do something entirely unpredictable.

This is the thing that can keep instructing from becoming the unbearably monotonous routine of going through the same procedure day after day that it sometimes appears. Those instructors who have little understanding of the human factors involved and very little interest in them must necessarily find themselves in a hopeless rut of repetitious maneuvering. For this reason no pilot, who is not just as much interested in people as in flying, should become an instructor, and certainly not a primary instructor.

The man who solos a student knows more about him in a great many ways than his doctor or even his father. He knows, provided he has the sagacity to interpret the evidence, the elements of the student's character that are too fundamental even to be expressed in words. He knows how he reacts to danger and difficulty; how much consideration he has for the safety of others; how he responds to suggestion and criticism; how much discouragement he can take with good humor when things go wrong. He also learns whether he is weak-willed or stubborn and his whole general attitude toward solving problems and overcoming difficulties; which means, of course, toward life itself.

The primary instructor is not baffled in his observation of all these things by well-developed poses or by evasion or by reticence, such as may exist in almost any other circumstance. The student learning to fly has not learned how to cover up his weaknesses in a situation which is so completely new to him. He is too busy with necessary concentration to pretend, or to succeed in making any particular impression that he might like to make. He must concentrate, decide and act instantaneously. He is so busy trying to be a pilot that in the business of being a man he is caught completely off guard and his instructor sees him as he really is.

Not many men are capable of interpreting and understanding such complete revelations of the human spirit. Many instructors see little more than just how a student performs his pre-



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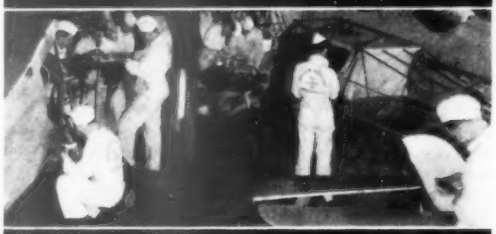

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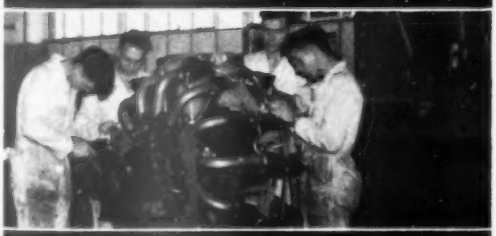

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scribed maneuvers. They can tell him what is wrong with his maneuvers—perhaps tell him how he is spoiling them—and in most cases this is enough. Sometimes, however, there are important reasons *why* a student does things; reasons that go deep into that student's character and which require more than a mere knowledge of flying to understand. These are the cases that give a brilliant instructor his chance to excel.

Not all cases of psychological difficulty will respond even to the wisest treatment. Most cases will not, for flying instructors are not magicians. They cannot change a mouse into a man or a defeatist into an optimist. But the smart ones sometimes can change a man's opinion of himself and sometimes his whole expressed attitude toward himself and his problems and, consequently, toward life itself; provided such a change of attitude is justified by the facts.

Any instructor who does not feel himself talented in the direction of human understanding should make the most of his opportunity to develop that quality, both by observation and study. He may even help himself to a little elementary psychology, which probably some day will be included in all instructor training, or delve into a book like Menninger's *The Human Mind*, which remains about the best understandable discussion of the hidden causes of human behavior. And he can always listen and learn from those instructors who obviously are studying students while the students are studying flying.

In this way he can discover the opportunities as well as the difficulties so simply stated by the veteran check pilot: "Each student is a different problem."

END

Soar for Future

(*Continued from page 29*)

"worthless" bands below 200 meters. They were limited to one kilowatt—and needed it all. Then some of them tried going down in the bucket of short wave and began to get amazing distance with very little power. In 1923 Comm. Donald B. MacMillan led an expedition to the Arctic and, somewhat reluctantly, allowed me to outfit him with radio. Through the excellent cooperation of the American Radio Relay League, using short wave of course, he was able to keep in contact with the United States all winter long, the first time this had been achieved.

In 1925 I had a personal demonstration of the genius of youth. I was commander of the *S. S. Peary* on the MacMillan expedition of that year. When we reached Disco Island on the coast of Greenland, I stopped at Godhaven to refuel and was informed by the governor that he could not grant such a request without authority from the Danish Minister in Washington. I looked at the high towers of his just-completed radio station and suggested that we radio the minister. He replied that his transmitter (600 meter) would not work in daylight and Disco is so far north that it was daylight 24 hours. Night would not come until September. This was June and I needed coal.

I told him that if he would use the *Peary's* short-wave station with which I had outfitted the ship, we could get a message through immediately. He was somewhat skeptical when he came on board and saw our little set and seemed surprised when I actually began sending out a call for an amateur in Washington. The boy answered in a few minutes and we asked him to run over to the Danish Ministry and get us permission to coal our ship. Within an hour the authorization came through from Washington and lighters were bringing out coal.

It seems strange today that we had to contact a kid amateur to send a message a few thousand miles. At that time, however, there were no commercial or Government short-wave stations. These amateur frequencies were regarded with the same disdain that many aviation interests hold for soaring. But the kids made so many discoveries that the short-wave bands are today by far the most valuable long-distance frequencies in radio.

Our experience with the ARRL in 1923 sold me on the value of short-wave under service conditions. The Navy laughed at me. However, I finally persuaded Adm. Ridley McLain, Director of Naval Communications, to commission a young amateur friend of mine, Fred Schnell, with the rank of lieutenant, so that the amateurs could demonstrate the value of short-wave to the Navy. Fred was on board the battleship *Seattle* off the coast of Tasmania at about 41° south latitude while we were at Etah, Greenland, only 800 miles from the North Pole and 140° of latitude east of Tasmania. When we established communication so perfectly that we were able to serenade the *Seattle* with an Eskimo quartet, the Navy decided that the short-wave transmission developed by American youth was really practical.

The theory of soaring and the story of its development in postwar Germany is old stuff to readers of FLYING AND POPULAR AVIATION. In transport and military aircraft we can see the fruits of development forced on soaring pioneers by the need for greater efficiency. Knowledge of soaring meteorology is proving its value in commercial power operation.

Europe's experience has not been paralleled in the United States because, up until last autumn, the sport of soaring was restricted to a handful of enthusiasts. However, interest in motorless flight has taken such a spurt in recent months that the entire situation is changing rapidly.

Youngsters from 14 to 50 have been taking lessons in various parts of the country, chiefly in the midwest and on the west coast. It is rapidly being demonstrated that good thermal soaring conditions are available practically everywhere. Wright Junior College of Chicago has 45 students taking soaring instructions: of the 10 students selected at Wright for the CAA power course, five were from sailplane students. The Lewis School of Aeronautics started courses in soaring in April. Purdue University and the University of Minnesota are doing active work in research and instruction. The Catholic Youth Organization is sponsoring soaring clubs this summer, as are

a number of youth and service organizations throughout the nation.

During the winter months there was a soaring school on the ice of Lake Geneva, Wis. Seven Chicago high schools are teaching their students to manufacture sailplanes, following plans supplies by the Frankfort Sailplane Company. Junior Achievement, an organization which forms "companies" of youngsters to teach them the chore of operating a business, is planning to sponsor the manufacture of sailplanes and gliders. A bill now pending in Congress might subsidize soaring to the tune of $5,000,000.

The important thing is that the summer of 1941 is going to see thousands of boys in the air who would be kiwis otherwise. The grand sport of soaring has finally taken hold in the United States.

Stan Corcoran is a good example of the development we may expect when our skies are filled with gliders. Stan started by building models and learned to soar in payment of an old debt. Then he wanted a sailplane, but did not have the money to purchase one of the expensive, imported, high-performance jobs on the market. So he decided to make one.

Despite his red hair and Irish name, Corcoran is thorough. He knew airplane design from the years he had spent experimenting with models. He made an intensive study of gliders to determine what characteristics he wanted in his ship, and added a few refinements of his own. Then he built the *Cinema*.

As an unknown with little experience he entered the National Soaring Contest at Elmira, N. Y., in 1938 and had the bitter experience of twice breaking American distance records—and twice seeing his distances bettered in the same meet. With flights of 183, 146, and 202 miles he averaged 177 miles per trial, an *average* that has never been equalled in any American meet. He did this with his homemade sailplane, competing against expensive imported jobs and pilots with many years' experience. His *Cinema* is now in commercial production at Joliet, Ill.

Soaring will produce few Stan Corcorans, just as radio produced only one Major Armstrong. But it will produce many a designer who will add his bit to the efficiency of gliders, which ultimately means to the efficiency of power planes. It will keep thousands of boys flying who would otherwise lose interest and from this group will come some of the great flyers and designers of the future. When the time comes, as it soon will, that there are hundreds of thousands of boys continuing in aviation, we can expect marvelous progress, for there is no limit to the creative genius of American youth.

END

Pioneer Sky Girls

WHAT has become of the small handful of young women who pioneered the airline stewardess profession 11 years ago? United Air Lines, which employed the world's eight original "sky girls" in May, 1930, reports that four have married, one was secretly married all the time, one died after an automobile accident and two returned to nursing.

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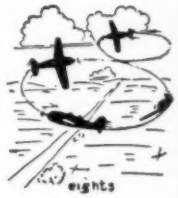

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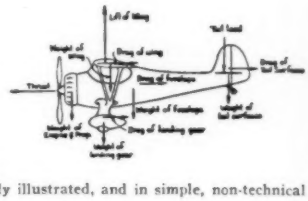

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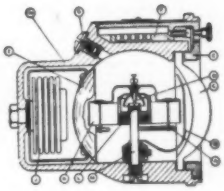

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Sky Hospital

(*Continued from page* 33)

The German Condor Legion afforded the first practical demonstration of this work. Wounded men were transported from Spain to Germany over flight distances of from 1,375 to 1,625 miles in trimotor Junkers Ju-52 transports. Equipped for blind flying, they carried two pilots, radio operator and first-aid attendant. Fuselages were modified for a longitudinally-divided loading hatch such as is found on many freight-carrying planes. They carried six stretchers and two seats for patients. Despite their many deficiencies as hospital transports, they did point the way to more elaborate ships.

These flying ambulances' flight route from Spain to Germany was beset with many aeronautic and meteorologic difficulties. They flew across the Mediterranean to Northern Italy, then northward to Germany. Over the Alps there was constant formation of ice on wing and control surfaces. Adverse wind conditions presented a constant problem. Nevertheless, the planes made it possible to take wounded to Berlin for special treatment in from eight to 10 hours. Even though the Condor Legion field hospitals were well-equipped, the badly wounded often required special treatment and could not be returned to Germany for several weeks by usual transportation methods. This was due to the two-day rail trip necessary from field hospital to the Spanish port of exit, followed by a five-day steamship voyage to Hamburg. In bad weather these steamship trips were hard and strenuous. The great advantage of using airplanes is clearly apparent.

During the ambulance flights from Spain to Germany, it was found that cold had a marked effect on patients. In part this was due to the troops' lack of winter clothing. Blankets were the wounded's only protection. Men with upper-arm fractures suffered most, no doubt because their right-angle splints prevented firm dressing and covering. The patients' most disagreeable flights were those at low altitude with limited ground visibility and rough weather. Because of this, the ambulance planes flew at the high altitudes as much as possible. Just before reaching German airports, low-hanging cloudbanks and frequent squalls resulted in the patients—who had otherwise been fairly comfortable—suffering from air sickness.

Taking advantage of these lessons, German ambulance planes were put into immediate operation in the invasion of Poland. More than 2,500 wounded and sick were sent back to Germany by air transportation. Only four died during flight or immediately after a landing was made. This is significant when it is realized that three were suffering from grave peritonitis and little hope was held for their recovery from the time of injury.

There is no doubt that air transportation is least painful to the wounded. At the same time transportation time from field hospitals to clinics and home hospitals is greatly lessened. This opens an entirely new possibility for treating the seriously wounded. When transportation was limited to the motor ambulance, the aim of the field surgeon's activity only could be to do the best he could under the given conditions and with what limited equipment and remedies he had at hand. When the conditions and speed of modern warfare are considered, the drawback of ordinary transportation is seen at once.

The basis for front-line surgery is created by the great advances made by peace-time surgery. At the same time, land transport motorization has not kept pace with modern surgery's advances. Hence the importance of the airplane. Experience has demonstrated that surgery at the fighting front must always be conservative. It of necessity must be limited to emergency operations. Major operations can be undertaken only under conditions corresponding to and measuring up to modern requirements.

For instance, a patient suffering from a gunshot wound in the stomach and intestines was picked up near Warsaw, Poland. He reached the operating table at the University of Breslau approximately 2½ hours after being wounded, the actual flight time being but 90 minutes. Thanks to this speed and proper care, the soldier made a complete recovery without complications. Of some 19 soldiers suffering from eye wounds and flown to the same university clinic by ambulance plane, 10 recovered. Usually there is not much hope held for individuals with such eye wounds, so these results were excellent. Jaw and brain wounds require specialized surgery. For final treatment of deep and ragged shot wounds X-ray diagnosis is absolutely essential. Of 19 typical cases taken from Poland to Germany for treatment, all recovered. A comparison of surgical cases during the first World War and a like number of cases during the rape of Poland shows clearly the remarkable aid given by the flying ambulance.

The Junkers transports were used in Poland as in Spain. Selection of a commercial-type plane for ambulance use was wise, since the general requirements for transporting wounded are about the same as for regular air travel. Modifications made them superior to those used in Spain and exploded the idea that such craft must be especially designed. Four removable stretcher-racks were fitted into the cabin. These racks, secured rigidly to the fuselage wall, were so built that they permitted no motion in any direction. No need for springs—in flight or in landing—was found to exist. Lying in pairs, one beside or above the other, each patient is reached easily from the aisle. Enough room is provided for changing bandages, taking temperatures, and giving injections.

Included in each plane's equipment is a complete medical and surgical kit containing syringes, cardiac and sedative preparations, sterile gauze, splints, padding materials and all other supplies necessary. The large number of spinal injuries forced inclusion of bedpans.

The greatest difficulty with flying ambulances is that suitable landing fields, where automobile ambulances may drive close to the plane and at the same time large enough to permit several ships to

operate at the same time, must be located beforehand. In addition to this, the fields must be placed so they are adjacent to field hospitals, thus providing for orderly and efficient evacuation. In Poland much time was wasted after the plane had landed. In some instances ships had to wait as long as five hours before taking off for Germany. Much of this time was lost in bringing the patients up to the planes and loading them aboard.

The evacuation of the wounded by air, through the elimination of the factor of distance, has brought the home hospitals' highly-developed surgical and medical facilities right up to the fighting front. The worth of this is apparent immediately. But only after this present conflict is over will we be able to realize fully just how important the airplane has been in allaying the fighting man's pain and suffering.

END

The Library

(*Continued from page 34*)

ground school. Each step of his training is given a separate treatment.

Function of each of the four chief types of military flying is explained in detail. The author explains how a reconnaissance plane, a bomber, a fighter and an attack-bomber are flown. How bombing is accomplished is one of Mr. Peck's most interesting chapters. The book is worthwhile to an airman, pilot or student. The volume is an important reference work.

FIRST BLOOD FOR THE RAF

by Charles Gardner. 272 pages. David McKay Company, Philadelphia. 1941. $2.50.

The true story of the losing fight waged by the RAF in France just before the blitzkrieg of May, 1940, remained largely a matter of rumor until the publication of this volume. Mr. Gardner is a war correspondent for the British Broadcasting Company who invaded France with a transcription-recording unit and who went about from one RAF squadron to another broadcasting the sound of battle. Because his radio-news dispatches were broadcast by the BBC immediately, he was something of a celebrity among correspondents.

Many historic figures in the Advanced Air Striking Force of the RAF came to know him intimately. He and "Cobber" Kain, the New Zealander who became the first ace of this war, once tried to billet their midget automobile in a hotel lobby. He was an eyewitness to the whole futile campaign, from the first preparation for battle to the sensational escape of the BEF from Dunkirk.

Because this book is compiled from his day-by-day journal, it is crowded with names, statistics, actual places and established happenings. He penetrates the screen of impersonality which has always been so characteristic of British military censorship and tells what really occurred. He suffered many an injustice at the hands of the censors and he has no love for them. The book is richer for his embittered anecdotes.

He thinks British brass-hats are a bunch of stuffed-shirts and says so.

AIR NAVIGATION AND METEOROLOGY

by Captain Richard Duncan, M.C. 290 pages. Glossary of terms and definitions. Goodheart - Willcox Publishers, Chicago. 1941.

This book is a somewhat novel method of teaching its subject, because it consistently plays down the mathematical phase of aerial navigation and advises the student to look up the answer in tables and almanacs available for that purpose. The chapters on the versatility of dead-reckoning are so complete that the reader can see many new applications for it which will substitute for more expensive and technical radio and instrument navigation. For those who have study facilities available, there is comprehensive instruction in the principles of radio and instrument navigation, together with excellent instruction in elementary celestial navigation as applied to flying. The author is a former RAF flight commander, holder of the Military Cross and now an instructor in avigation.

His treatment of meteorology is entirely from the navigator's angle. The book is not calculated to coach students who want to specialize in aviation me-

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teorology, but rather to teach aerial navigators how to identify weather symptoms, how to avoid sudden weather trouble and how to take advantage of good conditions when they prevail.

AIRPLANE WELDING AND MATERIALS

by J. B. Johnson, M.E. 370 pages and appendix. Goodheart-Willcox Publishers, Chicago. 1941.

Herewith is the second edition of a well-received technical handbook. This edition has gone into great detail about materials, new alloys and new methods of welding the older ones. It requires a certain familiarity with welding processes on the part of the reader. If he is a student at a technical school, or an apprentice welder already employed in an aircraft plant, this volume will teach him the tricks of the trade and qualify him for a higher rating. It is a comprehensive manual of the entire aircraft welding trade, with instructions for each step of the work. The book contains 193 illustrations and drawings to aid the reader in understanding this complex subject.

The author is chief of the materials laboratory, Materiel Division, U. S. Army Air Corps, at Wright Field. He has developed many of the excellent new welding processes described in his book and can speak about them with authority.

AIRCRAFT INSTRUMENTS

by Orien Edward Patton. 200 pages and appendices with calibration charts. D. Van Nostrand Company, N. Y. 1941. $2.75.

While designed primarily for the technical-school student and Air Corps cadet, this volume is a complete index to the design and function of all aircraft instruments in current use. Each is illustrated in a photograph and thoroughly explained with accompanying assembly drawings submitted by the manufacturers. More than 100 aircraft instruments are thus analyzed, ranging from the simplest thermometers to the most elaborate gyrocompasses. Instrument panels installed in all types of transport and private planes are presented in full-page photographs, showing the airlines' policies on arrangement of these devices into functional groups.

The volume answers many questions which have perplexed private flyers, such as the easiest method of reading more than 70 complex dials at a single glance, the method of utilizing combinations of instruments quickly to show engine or airplane abnormalities and why all these instruments were developed.

For one whose interest in flying has passed the lightplane stage and is looking ahead to bigger planes and an instrument rating, the volume will be a valuable aid. As a reference work for owners of good-sized private airplanes, who must check the work done on them by licensed mechanics, the volume will also prove beneficial. It is one of the most comprehensive books on the subject yet to appear. The author is an Army Air Corps instrument instructor.

END

Mae's the Boss

(*Continued from page* 39)

Middle westerners got a first hand glimpse of Miss America's aerial proficiency three years ago when the Chicago Girls' Flying Club gave its first full dress air show. The scene was Curtiss airport, now a Naval air reserve training field. Crowds looked on astonished as girls from homes and offices executed difficult loops, rolls and wingovers and proved their accuracy in spot landings. During National Air Mail Week the next year women pilots flew the mails into Municipal Airport, winning praise from the then Postmaster General James A. Farley.

Wilson airport, where the story of one trail-blazing woman pilot was written in terms of frequent discouragement and long hours of flying, is a level 48-acre tract situated in Schiller Park just outside Chicago. The port is home as well as office to Mae Wilson, a slender red-haired widow in her early thirties who operates it alone and unaided except for a mechanical assistant, Graydon Garvin, 29, and the four big dogs that guard it day and night.

Though Mae's case is outstanding it parallels that of many women pilots in one essential. Flying was not a preference but an expedient. No one in her family ever was a daredevil.

Until one evening in the spring of 1933 Mae was just another housewife who neither cared nor knew how to fly. She had married Roy Wilson of suburban Austin five years earlier and had seen him drop carpentering and auto selling in turn to fly for a living. When he leased the tract in Schiller Park, bought a Waco, erected a hangar and founded Wilson airport, she helped him establish their living quarters in one end of the hangar. The ensuing years witnessed a struggle for existence. Then came that fateful evening. Mae says:

"Roy had taken up a girl student to practice spins. When the plane went into the first one, I heard the motor and stepped to the door to watch. I was counting the spins. I reached four. Suddenly I knew they were too low to straighten out. I—shut my eyes then."

What caused the crash, Roy Wilson's widow never found out. The student didn't know, though she survived. One fact was clear—Mae faced the world alone. In the months that followed she recalled how often Wilson had tried to induce her to learn to fly. She had nervously submitted to a few lessons. But she didn't respond to his teachings and if she had shrunk from flying then, she liked it less now.

Bewildered by the tragedy, she summed up her tangible assets. There were the hangar and the simple home it included, the lease, and two airplanes: a Cessna and an OX-5 Travel Air biplane. She could let the equipment go, but that would mean sacrificing the things Roy had worked long to acquire. It seemed plain that if she was to get the most out of her legacy, she must use it.

Not every woman or man would have made the decision that she did—to stay

right there at the spot where her husband had met his death and to continue the enterprise which, through tragic mischance, had killed him. But Mae was convinced that it was the thing to do. She couldn't fly, it was true, yet she could hire somebody to handle the actual flying and teaching.

"But you can't run an airport that way," she declares. "Instructors came and went and, when they went, they took the students with them. We got by somehow for a few years but I realized that eventually I must learn to fly passengers and do the teaching myself."

She did learn, of course. Resuming her lessons where Roy had left off, she got instructions from various flyers and struggled through her first solo. When the feeling of control over an airplane came, her misgivings left. Finally she won a commercial flying license with an instructor's rating. But a new problem presented itself. Students weren't anxious to take their first lessons at the hands of a woman. Mae admits:

"Although I had perfect confidence in myself, it was hard for the student to share the feeling. After many disheartening rebuffs it occurred to me that the only way I could overcome a student's misgivings was by demonstrating that this kind of flying was simple. So I learned how to execute snap rolls, slow rolls, wingovers and other advanced maneuvers and, whenever I could enter an air meet, I did so, going through this repertoire of stunts.

"It was good advertising for me. It made primary flying look easy—which it is. I at last won the confidence of students and I seldom have that trouble any more."

So the woman who once didn't choose to fly has found her career in the air. Under her management Wilson airport has gone a long way. Nowadays there is a good body of students at the airport where two well-travelled thoroughfares meet and many of the "flying widow's" fledglings have progressed into private, commercial and military aviation.

Beside instruction flights, Mae Wilson's log evidences an average of 500 passenger hops a year. A veteran of many thousands of trips aloft, the woman airport operator averages four or five hours in the air on busy Sundays and has actually made more than two dozen flights for a total of seven hours on a single Sunday. That is almost half the flying time required of a private pilot in a year. Throughout, a record of many thousands of aerial miles flown with absolute safety has been established.

Mae recalls as one of her most interesting passengers on Sunday flights the late Jessie Reed of Broadway fame and, as one of her most distinguished assistants, the speed flyer, Harold Neumann, who left a routine job at the port to go into exhibition and race flying. Now he is a TWA pilot.

Mae believes it is essential that a flying teacher reach a thorough understanding with his pupil before he goes up the first time. Like most instructors, she is compelled to reject some applicants because they seem psychologically unfit to fly. Strangely enough the cocksure, "nothing to it" type seldom makes a good flyer, she finds, and she adds an observation of her own based on personal experience:

"I'd rather take a student with an advanced case of the jitters. It's natural to be a little nervous the first time." But perhaps she has a soft spot in her heart for the backward ones because she, too, learned flying the hard way.

END

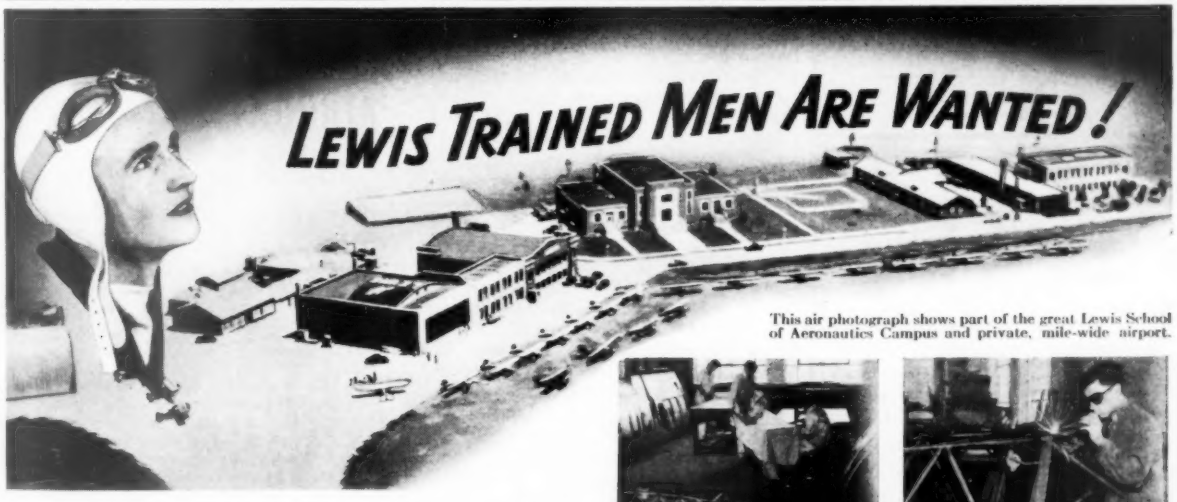
Wind Tunnels

(*Continued from page* 55)

built by many pioneer airplane builders. Their findings, however, were not available to the public. Tests were conducted to find the most efficient apparatus only for their own work.

Wind tunnels may be divided into two classes: The open-throat and the closed-throat types. Both are sketched in Section 6. The closed-throat tunnel follows the theory of a venturi tube. The propeller is placed back of the model and moves the air by suction to reduce turbulencies. In front of the model is a honeycomb to straighten the air before it reaches the model. Some of the honeycombs are made of double-layer sheets which are opened to equalize the airspeed over the whole tunnel area. Correction factors for closed-throat tunnels are larger than for open-throat tunnels.

Most large tunnels support models on



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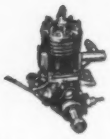

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wires connected to electrically-operated balances. Three scales are the minimum number required and are illustrated in Section 7. Two lift wires calculate the lift and the center of pressure of the model and the third wire gives the drag in direct measurement if the anchor wire is set at an inclination of 135°. Six scales will give location, magnitude and slope of the resultant.

Another difference in wind tunnels is that some circulate the air and in others the fresh air is drawn in at one end and discharged at the other end. The first is the closed circuit and the other the open circuit. A tunnel having a closed circuit is not influenced by its relative location in the building and by weather conditions. It requires about half the power of the open circuit type for moving the same volume of air.

One small demonstration tunnel with a closed circuit is outlined in Section 8. The throat opening is from six to nine inches and the overall height about 60 inches. A shutter controls the airspeed and vanes in the bends straighten the air.

Two wind tunnels sketched in Section 9 are used to investigate control actions on the stability of free flying models. One is the free-spinning tunnel and the other the free-flight tunnel. Both tunnels are slightly cone-shaped to keep the models approximately stationary, owing to the slowing-down of the airspeed at the wider portion of the tunnel. The free-flight tunnel is hinged, to place its axis parallel to the gliding angle of the model. A clockwork mechanism within the models moves the controls at a predetermined time to show their influence on the model's stability.

Small wind tunnels are easily built if not highly accurate. A sketch in Section 10 shows how the drag of a flat plate is measured and an example is added to indicate the numerical evaluation of the weights placed on the tray. The spindle carrying the plate is fastened to a cross pivoted on a hardened countersunk plate. The whole unit is prevented by guides from turning. A rod fastened to the cross and a collar sliding on this rod will balance and sensitize the readings of the instrument.

This example shows how the wind speed in a wind tunnel can be ascertained by first finding the pressure on the plate. Then, using the coefficients and equation in Section 11, the airspeed is obtained. A sphere would give closer values.

The center of pressure of an airfoil mounted on a spindle can be found by measuring the torsional displacement of the spindle. This requires very sensitive optical instruments. Fewer mechanical details are required by mounting the airfoil rotatable on a horizontal spindle as shown in Section 12. To find the center of pressure, determine the resultant of the lift and drag forces found by placing the airfoil vertically; then rotate the airfoil 90° and measure the drag forces. Multiplying the drag by the distance T and divide this moment by the resultant, which will give the moment arm of the resultant. Draw a circle about the pivot point and a tangent representing the resultant will intersect the airfoil at its center of pressure. This graphic method is the easiest for approximation of results.

Another method of finding the center of pressure is to attach a torque arm to the spindle mounted in ball bearings, as sketched in Section 15. Two closely-spaced stops allow light movement of that arm, to which a tray is connected. The weight times the torque arm is the moment, which, if divided by the resultant, gives the distance of the center of pressure from the center of the spindle.

In Section 13 the platform of a small wind tunnel is sketched. A honeycomb about 529 feet square straightens the air blast generated by a ¼ or ⅓ h.p. motor. The propeller should have blades wider close to the hub to equalize the airspeed over the whole area. Usually there is a lower speed at the center section.

Instead of pivoting the cross as shown in Section 10, knife-edge bearings support each arm, as illustrated in the upper sketch in Section 14. The drag is found by releasing two opposite-lying bearings parallel to the air stream. Releasing the two bearings lying vertically to the airstream, the lift of the airfoil is measured.

To eliminate the creeping of the knife-edge design under heavy air loads, a bearing detail shown in Section 14 is suggested. A latch upholds a bolt with a countersunk spot into which a hardened pin swings freely. The pin is made adjustable. By swinging the latch outward, the bearing is lowered and the arm released.

Small wind tunnels are very helpful in

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eliminating unorthodox designs that should not be allowed to be tested in large wind tunnels until they show at least a fair hope of improvement over accepted designs. Small tunnels always can be checked by testing a standard airfoil and comparing the results with figures given by standard tunnels.

END

AOPA News

(*Continued from page 54*)

AOPA on Radio Board

Membership in the Radio Technical Commission for Aeronautics, one of the Government advisory bodies in the aviation field, has recently been conferred upon the AOPA and two of its officials have been named to posts on the committees comprising it.

The commission is a technical body which acts as the advisory group between technicians in radio and aviation, as well as coordinating these activities with new rulings of the CAA. It is composed of outstanding experts in both fields; it includes Col. Hugh E. Mitchell, U.S.A., noted radio authority now in the Office of the Chief Signal Officer; J. H. Dellinger, National Bureau of Standards and Adm. S. C. Hooper, U.S.N., representing the Navy Department.

Paul Goldsborough, AOPA's radio consultant, is secretary of the commission, with offices at 995 National Press Bldg., Washington. The AOPA, as an organization, is represented by Executive Secretary J. B. ("Doc") Hartranft, Jr., who, in addition to his other honors, titles and distinctions, now becomes entitled to the greeting "Mr. Commissioner."

"Doc" is sometimes on the other side of the country when meetings are called to order. In case this occurs during a meeting of the Radio Technical Commission for Aeronautics, Paul Goldsborough will sit in for him.

ANNOUNCEMENT

Members of AOPA are notified that the AOPA news will not appear in the next issue of FLYING AND POPULAR AVIATION because the issue will be devoted to the U. S. Army Air Corps.

Interstate Squadron

From Snowden Hunt of California, representative of the Interstate *Cadet* company, AOPA received a correction on the caption shown under the picture of his lightplane squadron last month. Hunt says: "You say our squadron covered 2,500 miles in 74 hours. That is just a little faster than I can walk. Actually our five ships covered the distance in 23 hours, giving an average of 104 m.p.h. In addition, five planes started and all five finished, in formation. The longest day's flight was from Fort Worth to Chicago."

Anyone knowing the present whereabouts of Russell Spangenburg, former AOPA Member and formerly connected with Stinson Aircraft Corp., Wayne, Mich., please wire J. B. Hartranft, Jr., AOPA National Service Office, Transportation Bldg., Chicago.

END

Cross Sections

(*Continued from page 46*)

of intersection of the cutting plane with the fuselage cross-section at *any* point along the length of the fuselage. This makes it possible to locate a bulkhead, former or turtleback at any point which seems structurally desirable to the designer. It may be seen, then, that if many more lines like the one contour line (just flowed in with French curve in the top view) were drawn, quite an accurately drawn cross section can be plotted at any point along the length of the fuselage.

(5) This is the next step: flow in with French curve a contour line between each corresponding point of curve intersection with each cutting plane (in the top view).

(6) Locate all formers in positions structurally desirable in the side view. Locate these same formers in the top view. The points at which the formers cross the fuselage contour lines locates corresponding points on each individual cross-section.

(7) In drawing the front view of each former draw the vertical center line, horizontal reference line, and the cutting planes (horizontal lines). In the top view measure out along the former to each contour line drawn on each cutting plane and transfer the measurement outward in each direction from the center line in the front view of the former. Continue this procedure until all points are located on all formers and bulkheads desired.

(8) Draw in structural details to complete the job.

If any problems or misunderstandings occur while reading the explanation they may be easily clarified by studying the drawing. Here's a tip: if a fuselage has a bulge of some sort, use more cutting planes throughout that sector in order to locate enough points to plot a reasonably accurate section.

Now *you* can design a ship with any desired fuselage cross sections and be assured that it will have smooth flowing lines when completed.

END

Woman Instructor

THE only woman flying instructor in an American military school is Miss Ruth Stilson of Wentworth Military Academy.

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Navigation

(*Continued from page 34*)

amounts indicated at the intervals of 15, 30, and 45 minutes; at the end of one hour the aircraft would be at point P. The drift angle in this case is the angle AEP.

Given the desired track and the wind, the required heading of an aircraft may be determined graphically as follows (see Figure 3): Draw a line from E in the direction of the desired track. Draw E→W representing the wind's speed and direction. From W as a center and with a radius equal to the airspeed, strike an arc intersecting the track at point P. The direction W→P is the required heading which the aircraft must steer in order to make good the desired track.

The heading may and should be determined by means of any of the various mechanical computers designed for the graphic solution of wind triangles. These save considerable time and in addition obviate the necessity of plotting on the chart, which is often difficult when flying solo without an "automatic pilot." Of these computers the Dalton Mark VII is considered the best developed so far.

An example from Tornich's "Radius of Action of Aircraft" illustrates the simplicity of solving wind problems graphically when using standard terms and plotting on the Universal Plotting Chart.

Given the true course (track) between two points is 30°, distance 200 miles, the wind is from 270°, 30 m.p.h. The airspeed of the aircraft is 146 m.p.h. Find the heading and groundspeed.

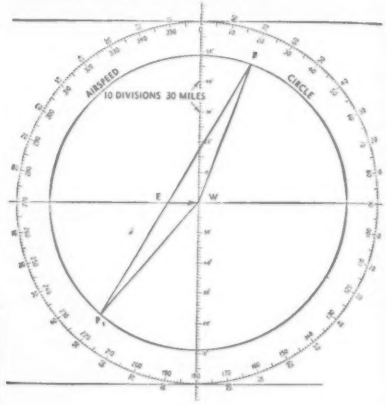

Fig. 4

Procedure: (Figure 4.)

1. Select a scale of miles for the midline divisions on the plotting chart; in this case let 10 divisions equal 30 miles.

2. Mark the center of the plotting sheet W and locate E with respect to W by laying off a line in the direction 270° equal to 30 miles, the speed of the wind. Draw E→W.

3. With W as a center, draw a circle with a radius equal to the airspeed of the aircraft, 146 miles.

4. From E, draw a straight line in the direction of the track, 30°, to intersect the airspeed circle at P. Draw W→P.

IN THE COMPLETED TRIANGLE FOR ONE HOUR OF FLYING

E→W = wind speed and direction = 270°, 30 m.p.h.
W→P = heading and airspeed = 20°, 146 m.p.h.
E→P = track and groundspeed = 30°, 159 m.p.h.
Angle WPE = drift angle = 10°, right.

In Figure 4, the point P is the aircraft's position at the end of one hour. It should be noted that it is necessary to determine the groundspeed being made good in any problem before a complete solution may be had. In general, the groundspeed is determined for one hour and used as a factor for finding the time to fly from one point to another when the distance between the two points is not great.

In the foregoing problem, the groundspeed is found to be 159 m.p.h. The distance between the two points is 200 miles. Provided the aircraft maintains a groundspeed of 159 m.p.h., the time to fly from one point to the other will be:

$$\frac{\text{200 miles}}{\text{159 m.p.h.}} = 1.25 \text{ hours, or 1 hour, 15 minutes.}$$

The above diagram which provides the solution for flying "out" to a given point may be extended to find the required heading, groundspeed and time to fly back or "in" to the point of departure.

Procedure: (Figure 4.)

1. Extend the track line E→P back through E to intersect the airspeed circle at P.

2. Draw E→P_1 and W→P_1.

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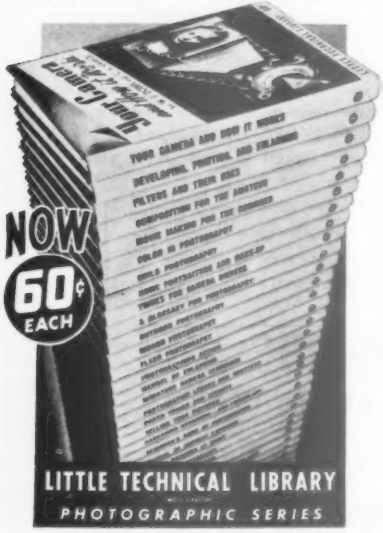

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IN FIGURE 23 (FLYING "IN")

W→P, = heading and airspeed = 220°, 146 m.p.h.

E→P, = track and groundspeed = 210°, 130 m.p.h.

Angle WP,E = drift angle = 10°, left.

The groundspeed on the return trip is found to be 130 m.p.h. and the time required for the return trip will be:

$\frac{200 \text{ miles}}{130 \text{ m.p.h.}}$ = 1.53 hours, or 1 hour, 32 minutes.

Another example of standardized terms is the Navy system of time designation, which gives in four-digit numbers the hours and minutes from 0 to 24. Thus, 8:40 a.m. would be 0840; 10:10 p.m. would be 2210, etc. These and other terms made standard for naval and military use recently have been adopted by the CAB and incorporated as "Standard Phraseology." By learning the new standard terms, the beginner will not have to "unlearn" and learn anew terms in everyday use.

END

Toys for the War

(*Continued from page 42*)

solid models.

From the metal templates, the boys cut the various sections of the airplane, using woodworking machinery wherever possible. The bulk of the work, however, must be done by hand. Each boy is assigned some part of the model to make, working on that part only during his stay in the class that day. The classes change every two hours and the new class starts in where the previous class left off, thus developing a regular mass production assembly line. As the parts come off the line they are sandpapered and smoothed down. Other boys start the glueing of the parts to the fuselage, and when these jointed sections are dry others apply putty to give the necessary streamlining and rounded curves at the joints. When completely assembled the planes are painted in the exact colors of the actual plane, with all the realistic camouflage found on warplanes. Even the markings are handpainted.

When finally ready for shipment, the solid model has been fitted with a celluloid painted circle to resemble whirling propellers, windows have been painted in, and radio aerials added. Then the planes are shipped from Ottawa by the air force to the training centers of the British Commonwealth Joint Air Training Plan.

There the planes are used to instruct the future fighter crews in the maneuverability of the different types of airplanes, to teach aerodynamics, range estimation of armament of the different planes and the different aspects which the plane presents to an enemy plane. Armament instructors use the models to teach fighter pilots where to find the "blind spots" of enemy planes and how to protect their own vulnerable spots from enemy fire. Hundreds of the planes are now in use throughout Canada to teach the fighter pilot, gunner and observer to identify the different types of planes now in use overseas.

All models turned out by the Ottawa schoolboys are on a scale of one-twentieth size. Not only do the boys make the better known types of British and German planes as *Hurricanes, Spitfires,* Heinkels and Messerschmitts, but also the latest types of British planes such as the *Whirlwind* and *Stirling* about which little is known as yet. So carefully are the silhouettes of these planes guarded that photographs of the models made by the boys may not be taken. Work on still later models as the *Tornado* and *Typhoon* is expected to start later.

In addition to making models, the boys are also taught to know the vulnerable spots of all the types of planes they are building, are shown where the armament on each plane is located and the firing range of each plane's guns and cannons. They are taught to draw silhouette views of the planes from every angle, so that they know each type by sight.

END

Letters

(*Continued from page 6*)

worked on an airplane, watched it take off, then suddenly realized that I hadn't done something I should have done. And then have had a young fit and sprouted grey hairs until the plane landed. . . .

L. H. SUMMERS, JR.
120th Observation Squadron,
U. S. Army Air Corps.
Biggs Field, Tex.

● Do other mechanics like Reader Summers' suggestion?—Ed.

Enlisted Pilots

Sirs:

. . . In "Speedy," by C. A. Bell [May issue, FLYING AND POPULAR AVIATION], I read: "Up to that time, only Annapolis academy graduates and officers on duty with the fleet could take training."

This is an error. As an Aviation Machinist Mate First Class, I started flight training at Pensacola in February, 1926, and graduated in October, 1926. . . . I don't doubt but what Mr. McDonough received a good share of his flight instruction from some of the older enlisted men pilots who are Naval Aviation Pilots.

In "Ferry Hop" [same issue], Mr. Miller, the author, does admit there was one enlisted pilot in the plane in which he rode out to Cavite; but he . . . does not mention that one of the crew's enlisted men was a Naval Aviation Pilot. I wonder if Mr. Miller was afraid that some reader might get the idea that said enlisted man was just as well (or possibly better) qualified than he was.

I, too, had the pleasure of making that trip to Cavite in the newly overhauled PBY's, over the same 5,500 miles; I also had the job of bringing the old planes (that VP-21 had been using, but had not overhauled) all the way back. That flight caused many more hours of worry than the one going out.

L. R. WARE,
U.S.S. Yorktown.
Pearl Harbor, T. H.

END

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Pushers for Tomorrow

(*Continued from page 50*)

rear end of the crankshaft and drives through the hydraulic vibration damper; then an idler gear, a combination spur-and-bevel gear and inclined drive shafts to the camshaft of each cylinder head.

Co-axis propellers still are definitely in the picture and may be used in the pusher design to minimize unstable forces. Recent research on extension shafts in the wings using a central power plant in the fuselage show them to be impractical. United Aircraft proposes a central power plant design, but it probably will come to the same unfavorable end as have other similar designs.

From this, one realizes that a definite step forward in the design of the pursuit plane lies in pusher-type propulsion. Today, stability problems in the pusher are being solved by using long-nosed fuselages to balance the huge engines behind the wing and a long lateral moment arm to provide maximum directional and lateral stability. The problem of protecting the pusher propeller from rocks thrown by the wheels has been solved by the design of special wheel guards or fenders. Danger to the pilot from the propeller while attempting to jump to safety by parachute is reported to have been solved by developing a catapult which shoots the pilot through a trap door in the bottom of the fuselage with sufficient force to clear the propeller arc.

Here's a peculiar forecast. Look to the old for the new. It proves itself time and again. Ideas are conceived, sometimes used, and then discarded. Years later these same ideas are presented as revolutionary advances in aviation. Typical examples would require a volume to enumerate. Tricycle landing gears, flaps, retractable landing gears and spinners for propellers are several prominent examples.

The next old idea that will be resurrected and considered revolutionary may be a plane equipped with a central power plant. The idea is quite old. It has been tested and discarded. United Aircraft and all other companies may begin using this design soon. New improvements are constantly being developed that surmount the problems which stumped the original inventors of an old idea.

In view of this, design predictions can be fantastic to the layman and yet not astound the engineer. One year ago the public would not believe that aircraft could ascend and descend vertically or fly backward, forward and sideways. But such a craft is the new helicopter designed by Igor Sikorsky.

END

Music for Morale

WEEKLY lunch hour concerts of semi-classical and popular music and group singing entertain Republic Aviation workers. The music, provided by a WPA symphony orchestra, is expected to provide relaxation and improve employee morale.

Want a Job?

(*Continued from page 72*)

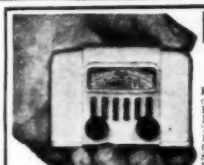
manufacturing plants out here. His story:

He took a public school course in sheet metal work. With 180 hours of practical sheet metal work under his belt, he went out to Southern California to look for a job. Once there, he methodically set about following the rules for getting work that we've been pounding at for eight months in this column. He went to several of the manufacturers' personnel offices, listed on the application they handed him *everything* he had ever done, and presented his certificate from the sheet metal course. He presumed that if he got work, it would be in the line for which he was best trained. He had once been a moving picture theatre manager and thought that might qualify him for some sort of clerical or bookkeeping work. When he got a job, they handed him a file and set him to work removing the burrs from aluminum alloy castings—a job which he informs us he could have done with considerable efficiency at the age of 12 *without* any special courses in sheet metal work!

We understood his puzzlement and tried to tell him what we knew to be true: that his course in sheet metal work actually is what led the company to hire him; that unless he had taken it, whoever decided to hire him as a casting filer might have passed him up completely, and written "no mechanical experience" on his application. He's still a little puzzled, though—like the ex-cartoon-animator we know who is working at one of the larger companies. This latter guy is making, of all things, the little cartoon sketches which the company plans to use to train its men on assembly operations! He tried to get an aircraft job for several months without success and finally got one only because the man who was interviewing discovered *by accident* that he was an experienced cartoonist. He hadn't bothered to tell anyone up to then. He couldn't see what connection there could be between drawing Mickey Mouses and building airplanes! . . .

See what we mean about telling your interviewer about *everything* you can do? He knows what he's looking for; you probably don't. Tell him all about yourself and let him decide if he can use you.

END



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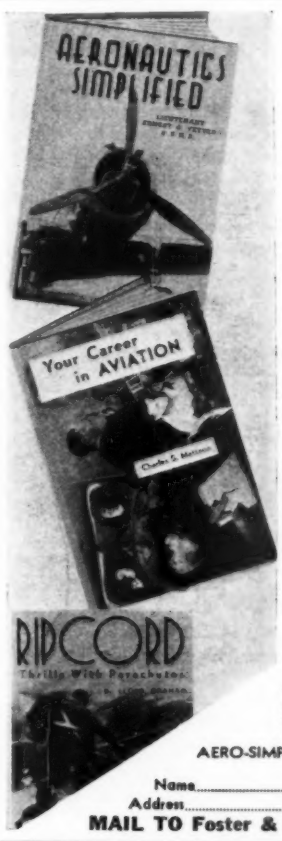

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Airy Chat

(*Continued from page 4*)

the 2,500-mile flight in less than 10 hours. All of us, with the exception of the radio operator and the dog (which slept most of the way), were in the big bomber's spacious cockpit throughout the trip. Though we took off shortly before 10 p.m., we saw the sun rise just before 3 a.m., which gives you some idea of how fast the *Liberator* can travel. As a matter of fact, the entire flight went so fast that we spent most of our time checking off cities that whizzed by beneath us. Sorry we can't pass on the ship's impressive performance figures.

Aside from eating the excellent turkey sandwiches put aboard before our take-off, and the sighting of a TWA *Stratoliner* 6,000 feet above us just outside of New York, the rest of the flight was identical to a routine airline flight, except for the lack of spaciousness and comfort.

* * *

What's-In-The-Wind. Lockheed's production of *Hudsons* now is said to be seven per day. Continental is reported to have an eight-cylinder opposed, air-cooled engine of about 265 h.p. about to go on the market. The first Lockheed *Lightning* (P-38) soon will go to the R.A.F. There are indications that the ferrying of British bombers from the west to east coasts will be handled not only by U. S. Army pilots but certain working airline pilots as well. Both TWA and United seem to be planning along those lines. TWA, incidentally, has just ended its rate-of-payment squabble with its *Stratoliner* captains. The *Stratoliner* pilots formerly were getting the same pay as for DC-3's and contended that, inasmuch as the four-engined Boeings get there quite a bit faster than the Douglases, their flight pay should be prorated accordingly.

The airlines are hurriedly training new pilots because they expect many old timers to be taken by the Army and Navy.

National defense measures are creeping into the airlines more and more. They all recently agreed to stop giving away free cigarettes and snacks in between meals. Free newspapers for distribution to passengers will be cut to a minimum. Reports that the lines may be "taken over" for national defense travel purposes, however, probably are based on the following true story:

A certain high-ranking Government official, who neglected to reserve a seat on an airliner, rushed up to the passenger agent who was loading the plane and demanded that one of the plane's full load of passengers be put off so as to get him aboard. When the passenger agent insisted that it could not be done, the official promised that, in the future, the airlines would be forced to give preference to men like himself—or else. However, it is doubtful that such action could be taken. A recent survey at LaGuardia Field showed that 85 per cent of all airline passengers travel strictly for business purposes. The belief is that the great majority of the 85 per cent—and of the remaining 15 per cent as well—can be attributed directly or indirectly to national defense work.

The license plates on the automobile of Maj. Stanley Umstead, Wright Field test flying chief, bear the number XB-19. Major Umstead, incidentally, has been selected by the Army and the Douglas company to fly the huge XB-19 on its first test flight soon.

The Government is buying up all those privately-owned transports to turn them over to the British. The latter will use them as water carriers in Egypt, it is reported. Alex Papana, the famed Rumanian ace, recently was seen waiting on tables in a restaurant in North Carolina. Curtiss-Wright recently got a $31,904,381.17 contract for airplanes and spare parts. On the same day Lockheed got a contract for $47,769,196.50 worth of planes. In three days in May, the Army Air Corps ordered $8,168,501.10 worth of—gasoline! Then, on June 4 and 5, the Army ordered $9,744,870.78 worth more! On June 3 they awarded Consolidated a contract for $226,636,200 worth of airplanes and Boeing a contract for $95,242,696.80 worth, both contracts being for heavy bombers (B-24 and B-17).

Republic Aviation Corporation paid its then-president W. Wallace Kellett (now chairman of the board) $36,120 in 1940. Donald Douglas was paid $75,080 in salary in 1940. Vultee's *Vengeance* will be used by the British as a dive bomber. The Indian Gliding Association of India has a contract from its government to train 300 pilots on gliders and has ordered several gliders from the Bowlus company, an American concern. There are 85 airports in the Philippine Islands, 46 of them commercial fields. The Ercoupe people now are working on a four-place ship as well as a flapped, 90 h.p.-version of the present Ercoupe. An Army Lockheed P-38 recently flew from Burbank to Kansas City in about four hours. Bruce Campbell, former United Press correspondent and frequent contributor to F&PA, is in the Army. Apparently he told Army officials that he had been connected with a "wire service," which is what an organization like the United Press is called in the newspaper business. Last word we had was that Campbell had been placed in charge of a wire-stringing detail at his encampment!

* * *

Wonder where they'd put us?

—MAX KARANT.

Aerial Red Cross

RELIEF WINGS, a new organization to "provide the humane use of aviation facilities in civilian service for peace or war-time disasters at home or abroad," is organizing rapidly throughout the United States, according to Ruth Nichols, executive director and a leading aviatrix. She recently completed a four months' air tour of the south for organization purposes.

"Our plan is to enlist experienced pilots and suitable airplanes for service in time of disaster," she reports. "We want flight surgeons and flight nurses who will not become upset through first air travel; and amateur radio stations for air-ground coordination." Ultimately Relief Wings wants to secure three twin-motored ambulance planes, especially equipped with a permanent bed, medical and surgical cabinets, oxygen tank and basins. These ships will be flown by the organization's regional directors in disaster service, as well as for individual emergency aid.

The organization divides the U. S. into 14 sections, based on disaster frequency, population pressure and size of states. Each section, headed by a volunteer director, comprises four volunteer corps led by civilian captains. Each is composed of at least 15 pilots and 10 airplanes; 10 flight surgeons, 10 flight nurses and an amateur radio circuit. Leading figures in the aviation world have endorsed the program.

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Laddie Hamilton, Tuscaloosa, Ala.	Super Chief Cont. 65	50 hr.		2000
Arthur J. Davis, Box 446, E. Lansing, Mich.	Chief Cont. 65	2 hr.	New	1950
Arthur J. Davis, E. Lansing, Michigan	Chief Cont. 65	2 hr.	New	1940
J. A. Atherton, Box 608, Rochester, Minn.	Chief '41 Lyc. 65	120 hr.	New	1750
Geo. T. Webb, Oneida, Tenn.	Chief Lyc. 65	75 hr.		1675
California Arcft. Corp., Metropolitan Arpt., Van Nuys, Calif.	Cont. 65	203 hr.		1650
G. E. Verhostra, 2010 Hollywood Pl., South Bend, Ind.	Super Chief Dual	35 hr.	Dem.	1650
G. E. Verhostra, 2010 Hollywood Pl., South Bend, Ind.	Super Chief Lyc. 65	22 hr.	New	1595
Leeward Aviation, New Kensington, Pa.	Chief 1939 Cont. 65	60 hr.	New	1450
Lenhart Flying Serv., Arpt., Marion, Ind.	TF Frnkln. 65	12 hr.		1395
Morristown Fly. Club, Morristown, Tenn.	Chief '40 Lyc. 65	362 hr.	No	1375
G. E. Verhostra, 2010 Hollywood Pl., South Bend, Ind.	Chief Lyc. 65 Dual	265 hr.	Dem. '40	1325
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Pierce Flying Serv., Box 894, Eureka, Cal.	Cont. 65	580 hr.	40 hr.	1290
Tred Avon Fly. Serv., Inc., Easton, Md.	Tandem Tr. Lyc. 65	275 hr.	No	1275
Aviation Market, L. A. Metropolitan Arpt., Van Nuys, Calif.	LW Warner 90	360 hr.	New	1250
O'Neal Flying Serv., Municipal Arpt., Evansville, Ind.	Chief Lyc. 65 Cont. 65	300 hr.		1250
Baker-Eberle Aviation, Detroit City Arpt., Detroit, Mich.	C 39 Dual	200 hr.		1250
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Cincinnati Arcft. Serv., Lunken Arpt., Cincinnati, Ohio	TL Lyc. 65 Frnkln. 65	321 hr.	Never	1250
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Inter-City Avia., Inc., Boston Mun. Arpt., E. Boston, Mass.	Chief Lyc. 65	825 hr.	210 hr.	1250
Pierce Flying Serv., Box 894, Eureka, Calif.	65-TC Cont. 65	650 hr.	100 hr.	1250
Tred Avon Flying Serv., Inc., Easton, Md.	Trainer Lyc. 50	236 hr.	No	1238
J. A. Atherton, Box 608, Rochester, Minn.	Trainer Cont. 65	215 hr.		1200
Boulevard Arpt., Inc., Roosevelt Blvd., and Red Lion Rd., Philadelphia, Penna.	Chief Cont. 65	300 hr.	No	1200
Richmond Air Transp.,Byrd Arpt.,Richmond,Va.	Chief Cont. 50	510 hr.	30 hr.	1200
St. Louis Flying Serv., Lambert Field, Robertson, Mo.	KCA Cont. 50		Recently	1175
Cincinnati Arcft. Serv., Lunken Aprt., Cincinnati, Ohio	TF Frnkln. 60	275 hr.	Never	1150
Portland Flying Serv., Inc., Municipal Arpt., Portland, Maine	Chief Lyc. 55	800 hr.	560 hr.	1150
Blvd. Arpt., Inc., Roosevelt Blvd., Phila., Pa.	TL Lycoming 55	150 hr.	No	1150
Jenkins Air Serv., Inc., Munic. Arpt., Rochester, N. Y.	TL Lycoming 65	200 hr.		1150
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Lexington Fly. Serv., Inc., Lexington, Ky.	Chief Frnkln. 50	281 hr.	Topped	1100
Art Whitaker, Swan Island Arpt., Portland, Oregon	Trainer Lyc. 65	700 hr.	500 hr.	1075
Four Lakes Aviation Corp., Royal Arpt., Madison, Wisc.	Low Wing, Deluxe	427 hr.	350 hr.	1050
Cincinnati Arcft. Serv., Lunken Arpt., Cincinnati, Ohio	Lyc. 55	815 hr.	93 since Major	1050
United Aero Corp., P.O. Box 222, San Antonio, Texas	Chief Lycoming 50	550 hr.	550 hr.	1025
Cedar Rapids Arwys., Inc., Cedar Rapids, Ia.	TF Frnkln. 60	565 hr.	160 hr.	1005
Edwards Flying Serv., Inc., Flushing Arpt., Flushing, L. I., N. Y.	50C Cont. 50	650 hr.	Recently	1000
Richmond Air Transport, Byrd Arpt., Richmond, Va.	60TF Frnkln. 60	355 hr.		1000
Lenhart Fly. Serv., Munic. Arpt., Marion, Ind.	Tr Frnkln. 60	340 hr.	300 hr.	995
United Aero Corp., P. O. Box 222, San Antonoi, Texas	TF Frnkln. 60	750 hr.	635 hr.	975
Lenhart Flying Serv., Arpt., Marion, Ind.	TF Frnkln. 60	365 hr.	310 hr.	$950
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Inter City Aviation, Inc., Boston Municipal Arpt., East Boston, Mass.	Menasco Chief 50	250 hr.		925
O'Neal Aircraft Co., O'Neal Arpt., Vincennes, Ind.	La65 Lyc. 65	1100 hr.	950 hr.	900
United Aero Corp., P.O. Box 222, San Antonio, Texas	50 TL Lyc. 50	685 hr.	565 hr.	925
United Aero Corp., P.O. Box 222, San Antonio, Texas	TF Frnkln. 50	1475 hr.	1400 hr.	925
Wallace Arcft. Co., Clarcona, Florida	Trainer '40 Lyc. 65	125 hr.		900
Jenkins Air Serv., Inc., Mun. Arpt., Rochester, N. Y.	TF Frnkln. 60	620 hr.	Major 576 hr.	900
Southern Arwys. Sales Co., Mun. Arpt., Birmingham, Ala.	'38 Cont. 50	300 hr.	290 hr.	900
United Aero Corp., P.O. Box 222, San Antonio, Texas	Trainer '40 Frnkln. 60	875 hr.	650 hr.	875
Jones Fly. Serv., Sullivan Av. Arpt., Cols., O.	K Frnkln. 50	680 hr.	Fact. 150 hr.	875
Cedar Rapids Arwys., Inc., Cedar Rapids, Ia.	TF Frnkln. 60	650 hr.	No time since	867
Tri-State Aviation Corp., Cincinnati Arpt., Sharonville, Ohio	Frnkln. 60	605 hr.		850
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Portland Flying Serv., Inc., Municipal Arpt., Portland, Maine	Chief Struts Edo Floats			700
A. F. Schachterle, Perkiomen Valley Arpt., Collegeville, Pa.	Aeronca 40	180 hr.	No	700
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Flying Dutchman Air Service, Somerton Arpt., Philadelphia, Pa.	K Aeronca 40	650 hr.	18 since Major	625
Florida Aero & Supply Co., Cannon-Mills Fld., Orlando, Florida	K Aeronca 40	625 hr.	200 hr.	625
Lester Pierce, 2135 Broadway, Eureka, Calif.	C3 Aeronca 36	1430 hr.	Just modernized	600
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Hawthorne Flying Serv., Municipal Arpt., Charleston, S. C.	K Aeronca 40	583 hr.	583 hr.	595
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Pierce Flying Serv., Box 894, Eureka, Calif.	Aeronca 36	1550 hr.	20 hr. since fct. maj.	575
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ARROW SPORT				
E. R. Elliott Motors, Coeur d'Alene, Idaho	Arrow Sport V8 82 h.p.	198 hr.	No	650
Aero-Ways, Inc., Mun. Arpt., Cleveland, O.	Sport V8	520 hr.		525
Blvd. Arpt., Inc., Roosevelt Blvd., Phila., Pa.	Arrow Sport V8 82 h.p.	450 hr.	90 hr.	500
BEECHCRAFT				
Harry A. Hammill, Box 992, Austin, Texas	Wasp 450	600 hr.	600 hr.	13000
Harry A. Hammill, Box 992, Austin, Texas	Jacob 330	850 hr.	850 hr.	8500
E. W. Wiggins Arwys., Inc., Providence, R. I.	C-17-B Jacobs 285	600 hr.	Recently	4800
Colorado Avia. Co., 426 U.S. Nat'l B.B., Denver, Colo.	Jacobs 285	800 hr.	Just	4250
Rochester Aeron. Corp., Rochester Arpt., Rochester, N. Y.	1935 Jacobs 225	735 hr.	50 hr.	2100

FLYING and POPULAR AVIATION USED PLANE LISTING OF

DEALERS	MODEL AND ENGINE		TIME	OVER-HAULED	PRICE
BELLANCA					
Art Whitaker, Box 3820, Portland, Ore.	Cruisair	Ken Royce 90	95 hr.	none since top	$3500
E. W. Wiggins Arwys., Inc., Providence, R. I.		LeBlond 90	150 hr.		2400
Atlantic Aviation Serv., Dupont Arpt., Wilmington, Del.	CH	Wright J-5	800 hr.	100 hr.	1695
BIRD					
Lane Air Serv., Albany, Georgia	Deluxe	Kinner 100 h.p.	900 hr.	Just	1250
Robertson Arcft. Corp., Lambert Arpt., Robertson, Mo.	CK	Kinner 125	1014 hr.	1941	1200
Florida Aero & Supply Co., Cannon-Mills Fld., Orlando, Florida		Kinner 90 h.p.	1500 hr.	250 hr.	795
CESSNA					
Aircraft Sales of Michigan, Detroit City Airport, Detroit, Michigan	Airmaster	Warner 165	New	New	9244
Tri-State Aviation Corp., Cincinnati Airport, Sharonville, Ohio	Airmaster	Warner 145	265 hr.	255 hr.	4850
Aviation Market, L. A. Metropolitan Arpt., Van Nuys, Calif.	C-39	Warner 145	210 hr.		4800
Hubert & Dillon Air Serv., Box 177-S, Tacoma, Wash.	C-145	Warner 145	475 hr.	ship be'g majored	2950
Bob Wight, Box 447, Alexandria, La.	AW	Warner 125	495 hr.	Just Licensed	700
Bob Wight, Box 487, Biloxi, Miss.	AW	Warner 125	495 hr.	Just relic.	700
CULVER CADET					
Tri-State Avia. Corp., Cincinnati Arpt., Sharonville, Ohio		Cont. 75	45 hr.		2100
Bishop Flying Serv., Inc., Bisnop Arpt., Flint, Michigan	LCA	Cont. 75	285 hr.		2000
Tri-State Aviation Corp., Cincinnati Arpt., Sharonville, Ohio		Cont. 75	40 hr.		2000
Tri-State Aviation Corp., Cincinnati Arpt., Sharonville, Ohio		Cont. 75	25 hr.		2000
Foster A. Lane, Pt. Columbus Flying School, Columbus, Ohio		Cont. 75	105 hr.		1850
New Mexico Flying Serv.,Box 67,Clovis,N.M.	LCA	Cont. 75	92 hr.	No	1850
CURTISS ROBIN					
Geo. Roper, 27 S. State, Salt Lake City, U.		Challenger	800 hr.	Mar. '40	800
Red Bank Airport, Inc., Red Bank, N. J.		Challenger 185	575 hr.	162 hr.	650
United Aero Corp., P.O. Box 222, San Antonio, Texas		Challenger 185	650 hr.	425 hr.	575
DART					
Ashcraft Bros. Fly. Serv., Mun. Arpt., Lawrence, Kansas	Dart	Ken Royce 90	360 hr.	300 hr. top over'hl	2000
DAVIS					
Aircraft Sales of Michigan, Detroit City Arpt., Detroit, Michigan	125	Warner	500 hr.	55 hr.	1200
ERCOUPE					
Aviation Market, L.A. Metropolitan Arpt., Van Nuys, Calif.		Cont. 65	55 hr.	New	2650
FAIRCHILD					
Aviation Market, L.A. Metropolitan, Van Nuys, Calif.	24	Warner 145	102 hr.		6000
Thomas Metcalf, Toledo Mun. Arpt., Toledo,O.	24	Warner 145	356 hr.	Topped 306 hr.	3975
T. A. Colbertson, Medford, Oregon	246	Warner 145	800 hr.	350 hr.	3500
Palo Alto Airpt., Inc., Box 640, Palo Alto, Cal.		Warner 145			2600
Jos. R. Higgins, Mozart Park, Wheeling, W.Va.	24	Ranger 145	790 hr.	10 hr.	2500
E. W. Wiggins Airways, Inc., Providence, R.I.	24	Ranger 145	700 hr.	Jan. '40	2500
E. H. Brockenbrough, Mun. Arpt., Charlotte, N. C.	24	Warner 145	350 hr.	Just	2395
Standard Flying Serv., Inc., Somerset Hills Airport, Basking Ridge, N. J.	24	Warner 145	485 hr.		2150
Aircraft Assoc., Inc., Munic. Arpt., Long Beach, Calif.	71	Wasp SC-1 450 h.p.	3184 hr.	447 hr.	2000
Aircraft Assoc., Inc., Munic. Arpt., Long Beach, Calif.	FC2W2	Wasp SC-1 450 h.p.	3240 hr.	409 hr.	2000
John P. Hall, West Haven Arpt., West Haven, Conn.	24	Warner 145	348 hr.	Recently	1650
E. W. Wiggins Airways, Inc., Boston Met. Arpt., Norwood, Mass.	24	Warner Series 40 125 h.p.	945 hr.	305 hr. since major	1350
E. W. Wiggins Airways, Inc., Providence, R.I.		Warner 125	1000 hr.	Recently	1350
California Aircraft Corp., Box 170, Van Nuys, Calif.		Warner 95	3000 hr.	175 hr.	1300
Art Whitaker, Box 3820, Portland, Ore.	24	Cirrus 100	1200 hr.	None since Major	1125
Doug Schall, Inc., 33 Clagett Rd., Hyattsville, Md.	KR34	Wright J65 185 h.p.	700 hr.	16 hr.	1050
Flying Dutchman Air Serv., Somerton Arpt., Philadelphia, Pa.	KR34 3 Polb	Wright 175	747 hr.	200 hr.	$900
FLEET					
Aviation Market, L.A. Metropolitan Arpt., Van Nuys, Calif.	10	Kinner 125	350 hr.		2500
Johnson Flying Serv., Inc., Missoula, Mont.	9	Kinner 125	1200 hr.	100 hr.	1750
West Coast Aircft., L.A. Munc. Arpt., Inglewood, Calif.	2	Kinner 100		Just	1550
Portland Fly. Serv., Inc., Mun. Arpt., Portland, Maine	2	Kinner 100	750 hr.	30 hr. since	1245
Granite State Airways, Manchester Arpt., Manchester, N.H.	2	Kinner 100	1300 hr.	1125 hr.	1200
White Fly. Serv., Inc., Caldwell-Wright Arpt., Caldwell, N.J.		Warner 125	1090 hr.	6/40	1095
FUNK					
Aircraft Unlimited, Inc., Roosevelt Field, Mineola, N. Y.		Funk E63	130 hr.	Top	1350
Island Crop Dusting Co., Airport, Caribou, Me.	75B		150 hr.	at	
Eugene Wise, Wise Arpt., R.F.D. #2, Uniontown, Ohio	B	Funk 63	400 hr.	130 hr. 175 hr.	1300 1095
INTERSTATE					
Aircraft Sales Corp., 1240 Lawrence Ave., Chicago, Ill.	Cadet	Cont. 65	48 hr.	Demonstrator	1745
KINNER					
Schneider Aero Serv., Chandler Fld., Fresno, Calif.	Sportwing	Kinner 125	1303 hr.	450 hr.	1150
Schneider Aero Serv., Chandler Field, Fresno Calif.	Sportwing	Kinner B-5	1312 hr.	215 hr.	950
LOCKHEAD					
H. A. Hammill, Box 992, Austin, Texas		Wasp 450		8 hr.	5000
LUSCOMBE					
California Aircraft Co., Box 170, Van Nuys, Calif.		Warner 90	350 hr.		3000
Carl Evers, 247 Park Ave., N.Y., N.Y.	Silvaire 75	Cont. 75			2650
Pete Grim, RFD #4, Staunton, Va.	Silvaire	Cont. 75	90 hr.	None	2500
W. F. Luke, Schenectady City Arpt., Schenectady, N. Y.	Silvaire 8.C	Cont. A.75	70 hr.		2400
Aircraft Sales Corp., 1240 Lawrence Ave., Chicago, Ill.	Silvaire	Cont. 75	72 hr.		2350
Page Airways, Municipal Arpt., Rochester,N.Y.	Silvaire	Cont. 75	121 hr.		2340
Carl Evers, 247 Park Ave., New York, N.Y.	Silvaire deluxe	Cont. 75	150 hr.	Yes	2200
Falcon Aircraft Corp., L.A. Mun. Arpt., Inglewood, Calif.	8A	Cont. 65	350 hr.		2200
C. W. Peterson, Mun. Arpt., Salina, Kansas.	8A	Cont. 65	100 hr.	None	2000
Carl Evers, 247 Park Ave., New York, N. Y.	Trainer	Lyc. 65	New		1950
Four Lakes Aviation Corp., Royal Airport, Madison, Wisc.	8B	Lyc. 65 Dual	173 hr.		1850
Air Serv., Inc., Mun. Arpt., Denver, Colo.	8A	Cont. 65	84 hr.		1850
Red Bank Arpt., Inc., Red Bank, N. J.	8A	Cont. 65	65 hr.	65 hr.	1850
Midwest Fly. Serv., La Grange, Ill.	8A	Cont. 65 Dual	125 hr.	None	1850
Aircraft Sales of Michigan, Detroit City Arpt., Detroit, Mich.	8A	Cont. 65 injector	590 hr.	90 hr.	1800
W. F. Luke, Schenectady County Arpt., Schenectady, N. Y.	8A	Cont. 65	113 hr.		1800
Doug Schall, Inc., 33 Clagett Rd., Hyattsville, Md.	8B1	Lycoming 65	30 hr.	New	1790
Tacoma Flying Serv., Box 157, South Tacoma, Wash.	8A	Cont. 65	1200 hr.	400 hr.	1750
E. C. Holtzman, Madison, Wisc.	8B	Lyc. 65	125 hr.	New	1725
Midwest Fly. Serv., La Grange, Illinois	8B1	Lycoming 65	40 hr.	None	1700
Midwest Fly. Service, La Grange, Illinois	8A	Cont. 65	225 hr.	None	1700
J. L. Wells, 106 W. Main, Avon Park, Fla.	8A	Cont. 65	95 hr.	None	1675
Knox Flite, Municipal Arpt., Knoxville, Tenn.	8B	Lyc. 65	250 hr.		1600
Upton & Bowen, West Memphis, Ark.	8A	Cont. 65	300 hr.	50 hr.	1600
Midwest Fly. Serv., La Grange, Illinois	8B1	Lycoming 65	150 hr.	None	1600
W. F. Luke, Schenectady County Arpt., Schenectady, N. Y.	8A	Cont. 65	350 hr.	50 hr.	1550
Thompson Fly. Serv., Inc., Salt Lake City, Utah	8A	Cont. 65	753 hr.		1475
Flying Dutchman Air Serv., Somerton Arpt., Philadelphia, Pa.	8A	Cont. 65	550 hr.	160 hr.	1475
Albert E. Padags, Tri-City Arpt., Wisc. Rapids, Wisc.	1940	Cont. 65	900 hr.	Major 936 hr.	1450
Thompson Flying Serv., Inc., Salt Lake City, U.	8A	Cont. 65	683 hr.	79 hr.	1375
Doug Schall, Inc., 33 Clagett Rd., Hyattsville, Md.	8	Cont. 50	Motor	100 hr.	1300
MEYERS					
J. A. Atherton, Box 608, Rochester, Minn.	OTW	Warner 125	555 hr.	5/41	4500
MONOCOUPE					
Fla. Aero & Supply Co., Cannon-Mills Fld., Orlando, Florida		Warner 125	945 hr.	240 hr.	1250
Bishop Flying Serv., Inc., Bishop Arpt., Flint, Michigan	33	Warner 125	772 hr.	250 hr.	1200
Bennett Air Serv., Box 247, Hightstown, N. J.	6-W	Warner 125	Flown 1290 hr.	74 hr.	1150

AUTHORIZED AIRCRAFT DEALERS

DEALERS	MODEL AND ENGINE		TIME	OVER-HAULED	PRICE
St. Louis Flying Service, Lambert Field, Robertson, Mo.		Lambert 90	1000 hr.	Recently	$995
Bishop Flying Service, Inc., Bishop Arpt., Flint, Michigan	M5	Velie 65	650 hr.	20 hr.	550
MOTH					
Carl Evers, 247 Park Avenue, N. Y., N. Y.	Gipsy Major 130		New		2800
Carl Evers, 247 Park Avenue. N. Y., N. Y.	Gipsy Major 130		New		2800
Ellis Eugene Eno, Eno Arpt., Fort Dodge, Ia.		Gipsy 90 h.p.	400 hr.	Never	500
Eno Flying Serv., Eno Arpt., Ft. Dodge, Iowa		Gipsy 90	400 hr.	Never	500
Ellis Eugene Eno, Eno Arpt., Fort Dodge, Ia.	DH	Gypsy 90	425 hr.	Never	500
NEW STANDARD					
O'Neal Aircraft Co., O'Neal Arpt., Vincennes Ind.		Wright J5	720 hr.	700 hr.	1100
Boulevard Arpt., Inc., Roosevelt Boulevard, Philadelphia, Pa.		Kinner 90	1500 hr.	700 hr.	700
PIPER CUB					
E. H. Brockenbrough, Mun. Arpt., Charlotte, N. C.	J4	Cont.65 '40	70 hr.	None	2200
Neil McCray, Arpt., Jamestown, New York	Coupe 41		80 hr.		2175
E. H. Brockenbrough, Mun. Arpt., Charlotte, N. C.	J4	Cont.65 '40	New	No	1900
Stiles Motor Co.,260 Main St.,Northport,N.Y.	Coupe J4A	Cont. 65	142 hr.	New	1900
Ben A. Funk, Hiway 50, Grover, Mo.	Seaplane	Lyc. 65	New	No	1850
L. L. Rupert, Box 446, Muskogee, Okla.	Coupe '40	Cont. Dual 65	155 hr.		1850
Piedmont Avia., Inc., Munic. Arpt., Winston-Salem, N. C.	J4 '40	Cont. 65	38 hr.	None	1790
Susquehanna Air Serv., Williamsport Arpt., Montoursville, Pa.	Coupe	Lyc. 65	35 hr.	New	1775
Lynn B. Fellison, 2811 Mulberry, St. Joseph, Mo.	J5	Cont. 75	83 hr.	New	1765
Otha Eddleman, Box 116, Crane, Texas	J4 Coupe	Cont. 65	132 hr.	Never	1750
J. L. Schroeder, Inc., Box 8055, Houston, Tex.	J4 '40	Cont. 65	93 hr.	None	1750
Southern Vt. Fly. Serv., Arpt.,N.Springfield,Vt.	Cruiser	Cont. 75	40 hr.	New	1750
Dubois Avia. Assoc., Mun. Arpt., DuBois, Pa.	J4 '40	Cont. 65	97 hr.		1700
McVey Flying Service, Monmouth, Illinois	J5A	Cont. 75	305 hr.		1700
McBoyle Cub Sales, Arpt., Lake Delton, Wisc.	J5	Cont. 75	61 hr.	New	1695
Tufts-Edgcumbe, Inc., Ravenswood Arpt., Des Plaines, Illinois	J4	Cont. 65	70 hr.		1675
Rudy Pickrul, Traverse City Arpt., Traverse City, Michigan	Coupe 1940	Cont. 65 Dual	62 hr.		1650
Philadelphia Skyport, Inc., Pier Three South, Philadelphia, Pa.	Seaplane	Cont. 65	774 hr.	90 hr.	1650
Herman L. Martin, Munic. Arpt., Walla Walla, Wash.	J4	Cont. 65	450 hr.	25 hr.	1600
Skelly's Fly. Serv., Greenville Arpt., Greenville, Pa.	J-4	Cont. 65	100 hr.	New	1595
Racine Fly. Serv., Racine Arpt., Racine, Wisc.	J-4	Cont. 65	383 hr.	353 hr.	1575
Barr Aviation Corp., Detroit, City Arpt., Detroit, Michigan	J4 Coupe	Cont. 65	175 hr.	None	1550
Al Gillis Fly. Serv., 125-1st Ave. No., Great Falls, Mont.	Coupe '40	Cont. 65	200 hr.	None	1550
Southern Air Serv., Memphis, Tenn.		Cont. 65	100 hr.	New	1550
Air City Flying Service, 5500 E. Third St., Dayton, Ohio	Cruiser	Cont. 75	150 hr.		1545
Eno Flying Serv., Eno Arpt., Ft. Dodge, Iowa.	Cruiser	Cont. 75	135 hr.	Never	1525
Smith Flying Serv., Wilkes-Barre Wyo. Vall. Arpt., Forty-Fort, Pa.	J-4A	Cont. 65	150 hr.		1500
Pete Grim, R.F.D. No. 4, Staunton, Va.	Cruiser, 41	Cont. 75	38 hr.	None	1500
P. D. Eyster, Tri-State Arpt., Angola, Ind.	J5	Cont. 75	85 hr.	No	1500
Smith Flying Serv., Wilkes-Barre Wyo. Vall. Arpt., Forty-Fort, Pa.	J-5A	Cont. 75	150 hr.		1500
E. H. Brockenbrough, Mun. Arpt., Charlotte, N. C.	J4 '40	Cont. 65	200 hr.	200 hr.	1500
Al Gillis Fly. Serv., 125 1st Ave., No., Great Falls, Mont.	Coupe '40	Cont. 65	350 hr.	None	1500
Desjardin Auto Serv., 24 Fairmount Ave., Worcester, Mass.	J-5	Cont. 75	100 hr.	New	1500
McBoyle Cub Sales, Arpt., Lake Delton, Wisc.	J3 Spcl.	Cont. 65	50 hr.	New	1495
Inter City Aviation, Inc., Boston Muni. Arpt., E. Boston, Mass.	'39 Couple	Cont. 65	196 hr.		1490
Wm. T. Swain, 301 Rochex St., Salinas, Calif.	J3	Cont. 65	593 hr.	170 hr.	1475
Wm. T. Swain, 301 Rochex St., Salinas, Calif.	J3	Cont. 65	480 hr.	140 hr.	1475
Racine Fly. Serv., Racine Arpt., Racine, Wis.	J-4	Lyc. 65	330 hr.	top 320	1475
Aviation Market, L. A. Metropolitan Arpt., Van Nuys, California	J4	Cont. 65	118 hr.	New	1450
J. L. Schroeder, Inc., Box 8055, Houston, Tex.	J3	Cont. 65	98 hr.	None	1440
Piedmont Avia., Inc., Mun. Arpt., Winston-Salem, N. C.	J5	Cont. 75	435 hr.	55 hr.	1425
Tufts-Edgcumbe, Inc., Ravenswood Arpt., Des Plaines, Illinois	J4	Cont. 65	550 hr.	50 hr.	1400
Lexington Fly. Serv., Munic. Arpt., Lexington, Ky.	J5	Cont. 75	230 hr.		1400
Reliable Fly.Serv.,P.O.Box 1303,Bristol, Conn.	J-4	Cont. 65	140 hr.	30 hr. fact.maj.	1400
Bennett Air Serv., Box 247, Highstown, N. J.	Coupe J4	Cont. 65	346 hr.	Just major	1398
Tufts-Edgcumbe, Inc., Ravenswood Arpt., Des Plaines, Ill.	J5	Cont. 75	575 hr.	Just	$1375
J. L. Schroeder, Inc., Box 8055, Houston, Tex.	J3	Frnkln. 65	142 hr.	None	1375
Lynchburg Air Transport & Sales Corp., Preston Glenn Arpt., Lynchburg, Va.	Coupe	Cont. 65	200 hr.	No	1350
Bennett Air Serv., Box 247, Hightstown, N. J.	J3	Frnkln. 65	150 hr.	50 hr. since	1350
Buffalo Aero. Corp.,Buffalo Arpt.,Buffalo,N.Y.	Cruiser	Cont. 75	275 hr.	Never	1350
Ben A. Funk, Hy. 50, Grover, Mo.	J3	Lyc. 65	15 hr.	Never	1350
Virginia Cub Distributors, Box 211, Farmville, Va.	Coupe '39	Cont. 65	350 hr.	Just Majored	1350
Virginia Cub Distributors, Box 211, Farmville, Va.	J3	Lyc. 65	145 hr.		1350
Wappingers Falls, Airport, N. Y.	Coupe	Cont. 65	135 hr.	No	1350
Southern Vt. Fly. Serv., Arpt., Springfield, Vt.	J3L '40	Lyc. 65	162 hr.	New	1350
Philadelphia Skyport, Inc., Pier Three South, Philadelphia, Pa.	J-3	Cont. 65 Dual	247 hr.		1325
TriCities Avia. Sch., TriCities Arpt., Endicott, N. Y.	J4 '39	Cont. 65	500 hr.		1300
Ellis Eugene Eno, Eno Arpt., Fort Dodge, Iowa	J3F65	Frnkln. 65	160 hr.	Never	1275
J. L. Schroeder, Inc., Houston Main St. Arpt., Houston, Texas	J-3 Trainer	Frnkln. 65	169 hr.	No	1275
Eno Flying Serv., Eno Arpt., Ft. Dodge, Iowa.	J3	Frnkln. 65	160 hr.	Never	1275
Southern Arwys. of Danville, Box 205, Danville, Va.	J-3	Cont. 65	385 hr.	Never	1275
Aviation Service Co., Inc., Box 32, Hartford, Conn.	J3	Cont. 65	80 hr.	New	1265
Linn County Airways, 221-3rd St., N.E., Cedar Rapids, Iowa		Lyc. 65	120 hr.	New	1260
Bennett Air Serv., Box 247, Hightstown, N. J.	J3 Trainer	Frnkln. 65	299 hr.	100 hr.	1250
Ellis Eugene Eno, Eno Arpt., Fort Dodge, Iowa.	J3F65	Frnkln. 65	175 hr.	Never	1250
Eno Flying Serv., Eno Arpt., Ft. Dodge, Iowa.	Trainer	Frnkln. 65	175 hr.	Never	1250
Baker-Eberle Avia., Detroit City Arpt., Detroit, Mich.	Coupe '39	Cont. 65	350 hr.	Top at 200	1250
Southern Vt. Fly. Serv.,Arpt.,N.Springfield,Vt.	J3L '40	Lyc. 65	280 hr.	New	1250
Madison Fly. Serv., R. 1, Madison, Ind.	J3L	Lyc. 65	205 hr.	No	1235
Mangen F. Warrington, Cub Fly. Serv., Selbyville, Del.	J3 '39	Cont. 55 dual	40 hr.	No	1200
John Ruzicks, Airport, Peru, Ind.	J3	Frnkln. 65	140 hr.	No	1225
Desjardin Auto Serv., 24 Fairmount Ave., Worcester, Mass.	J-4	Cont. 65	550 hr.	400 hr.	1200
Galbraith Air Serv.,Munic.Arpt.,Paducah,Ky.	J3L	Lyc. 65	102 hr.	No	1195
Dethloff Fly. Serv., Euclid Ave. Arpt., Willoughby, Ohio	J-3	Frnkln. 60	200 hr.	Top	1195
Tufts-Edgcumbe, Inc., Ravenswood Arpt., Des Plaines, Ill.	J3	Cont. 65	275 hr.		1175
Frank Rensma, Box 441, Youngsville, Pa.	J3	Lyc. 65	150 hr.		1150
Piedmont Avia., Inc., Mun. Arpt., Winston-Salem, N. C.	J4 '39	Cont. 65	385 hr.	75 hr.	1125
L-H Air Serv., Inc., Hatboro Arpt., Hatboro, Pa.	J3	Lyc. 65	300 hr.	300 hr.	1100
Madison Flying Serv., R.F.D. No. 1, Madison, Ind.	J-4	Cont. 65	325 hr.	No	1100
Eddie Braden, Easton, Pa.	J3	Lyc.	200 hr.	30 hr.	1100
Virginia Cub Distributors, Box 211, Farmville, Va.	J3	Lyc. 65	515 hr.	Yes	1100
Aviation Serv., Inc., Box 408, Newport News, Va.	J3L	Lyc. 65	528 hr.	None	1100
Madison Fly. Serv., R. No. 1, Madison, Ind.	Coupe	Cont. 65	335 hr.	No	1100
Inter-City Fly. Serv., Inc., Mun. Arpt., Ft. Wayne, Ind.	J3	Frnkln. 65	410 hr.		1095
Piedmont Aviation, Inc., Municipal Arpt., Winston-Salem, N. C.	Coupe	Cont. 65 dual	432 hr.	112 hr.	1085
Tufts-Edgcumbe, Inc., Ravenswood Arpt., Des Plaines, Ill.	J4	Cont. 65	450 hr.	100 hr.	1075
Eddie Braden, Easton Arpt., Easton, Pa.	J3	Lyc.	250 hr.	30 hr.	1075
South Arwys. of Danville, Box 205, Danville, Va.	J-3	Lyc. 55	570 hr.	Never	1075
Buroker-Hicks Flying Serv., Olympia Arpt., Olympia, Wash.	J-3 Trainer	Frnkln. 50	1087 hr.	115 hr.	1050
Des Moines Flying Serv., Municipal Arpt., Des Moines, Ia.	J3	Frnkln. 65	500 hr.	None	1050
Gerald Gallagher, 4507 Marvive Ave., Drexel Hill, Pa.	J-3	Cont. 65	720 hr.	95 hr.	1050
Ken's Cub Flyers, Olean Arpt., Olean, N. Y.	J-3	Frnkln. 60	720 hr.	20 hr.	1050
Madison Flying Serv., R.F.D. No. 1, Madison, Indiana	J-3	Lyc. 65	477 hr.	No	1050
J. L. Schroeder, Inc., Houston Main St. Arpt., Houston, Texas	J-3	Cont. 65	596 hr.	Yes	1050
Bob Howe, Gardner Arpt., Gardner, Mass.	J3	Frnkln. 60	188 hr.	New	1050
J. A. Atherton, Box 608, Rochester, Minn.	Coupe '39	Cont. 65	800 hr.	600 hr.	1050
Towners Fly. Serv., Towanda Arpt., Towanda, Pennsylvania	J-3-40	Lyc. 65	388 hr.	None	1050
Inter-City Fly. Serv., Mun. Arpt., Ft. Wayne, Ind.	J3 '40	Frnkln. 65	456 hr.		1050
Mid-Western Avia. Co.,406 Kirkpatrick Bldg., St. Joseph, Mo.	J-3	Frnkln. 60	192 hr.	None	1045
Palo Alto Arpt., Inc., Box 640, Palo Alto, Cal.		Cont. 65	1203 hr.	250 hr.	1000
Zimmerly Brothers Air Transport, Box 266 Lewiston, Idaho		Cont. 50	1300 hr.	90 hr.	1000
Aero Sales Corp., 1008 First Nat'l Bldg., Birmingham, Ala.	J-3	Frnkln. 60	400 hr.	275 hr.	1000
Spann Fly. Serv., Mun. Arpt., Colorado Springs, Colo.	J4	Cont. 65	650 hr.	200 hr.	1000

FLYING and POPULAR AVIATION USED PLANE LISTING OF

DEALERS	MODEL AND ENGINE		TIME	OVER-HAULED	PRICE
Richmond Air Trans., Byrd Arpt., Richmond, Va.	J3	Frnkln. 60	530 hr.	215 hr.	$1000
Midwest Avia. Corp., Norton Fld., Columbus, O.	Coupe	Frnkln. 60	600 hr.		1000
Stillwater Fly. Serv., Box 466, Stillwater, Okla.	J3C	Cont. A50-5	1073 hr.	N'w eng.	1000
L. L. Rupert, Box 446, Muskogee, Okla	J3F '40	Frnkln. 50	150 hr.	like new	1000
Paul Eyster, Tri-State Arpt., Angola, Ind	J3	Frnkln.	264 hr.	No	995
Paul Eyster, Tri-State Arpt., Angola, Ind.	J3	Frnkln. 60	249 hr.	No	995
Midwest Flyers, Lakeside Arpt., E.St.Louis, Ill.	J3F	Frnkln. 60	350 hr.	None	995
Mid-Western Avia. Co., 406 Kirkpatrick Bldg., St. Joseph, Mo.	J-3	Frnkln. 50	1230 hr.	Just	985
Midwest Aircraft Co., Harlan, Ia.	'30 Coupe	Cont. 65	500 hr.	1/41	975
Galbraith Air Serv., Munic. Arpt., Paducah, Ky	J3F	Frnkln. 50	398 hr.	No	975
Ben C. Arquitt, Mun. Arpt., Lima, Ohio	J3	Frnkln. 60	314 hr.	272 hr.	970
L-H Air Serv., Inc., Hatboro Arpt., Hatboro, Pa.	J-3	Lyc. 55	800 hr.	4/41	950
Wm. T. Anderson, P.O. Box 275, Essex Falls, N. J.	J3	Lyc. 55	218 hr.	Topped	950
Aircraft Sales Corp., 1240 Lawrence Ave., Chicago, Illinois	J3	Frnkln. 60	235 hr.		950
Tufts-Edgcumbe, Inc., Ravenswood Arpt., Des Plaines, Ill.	J3	Frnkln. 50	675 hr.	Never	950
Consolidated Air Serv., Rubinkam Arpt., Harvey, Illinois	J3	Frnkln. 60	570 hr.	None	950
Spann Fly. Serv., Colo. Springs, Colo.	J3	Frnkln. 50	1100 hr.		950
Herman L. Martin, Mun. Arpt., Walla Walla, Wash.	J3	Frnkln. 50	1100 hr.	50 hr.	950
Ray Wilson, Inc., Park Hill Arpt., Denver, Colo.	J-3	Frnkln. 50	850 hr.	mjr. 750 hrs.	950
McInnis Avia. Serv., Wold Chamberlain Arpt., Minneapolis, Minn.	J-3	Cont. 50	1100 hr.	50 hr.	950
G. L. Williams, Syracuse Arpt., Syracuse, N.Y.	J3	Frnkln. 60	998 hr.	Recent	925
Palo Alto Arpt., Inc., Box 640, Palo Alto, Cal.		Cont. 50	1416 hr.	518 hr.	900
Russ Walling, Walling-Watertown Arpt., Watertown, N. Y.	J3	Frnkln. 50	925 hr.	500 hr.	900
Fayette Airways, Inc., Connellsville Arpt., Connellsville, Pa.	J3	Lyc. 65	343 hr.		900
Fayette Airways, Inc., Connellsville Arpt., Connellsville, Pa.	J3	Frnkln. 65	407 hr.	147 hr.	900
Fayette Airways, Inc., Connellsville Arpt., Connellsville, Pa.	J3	Frnkln. 50	800 hr.	Yes	900
Avia. Serv., Inc., Box 408, Newport News, Va.	J3L	Lyc. 55	550 hr.	None	900
Consolidated Air Serv., Rubinkam Arpt. Harvey, Illinois	J3	Frnkln. 60	720 hr.	None	900
Al Gillis Fly. Serv., 125 1st Av. N, Great Falls, Mont	J3C	Cont. 50	900 hr.	50 hr.	900
Desjardin Auto Serv., 24 Fairmount Ave., Worcester, Mass.	J-3	Lyc. 55	900 hr.	700 hr.	900
Southern Air Serv., Memphis, Tenn.		Lyc. 50	300 hr.	New	900
Aero Sales Corporation, 1008 First National Building, Birmingham, Ala.	J-3-F	Frnkln. 60	600 hr.	275 hr.	895
Billie Carpenter, Box 15, Winfield, Kansas	J-3	Frnkln. 50	1450 hr.	1450 hr.	895
Warner Kenyon, 1326-29th St., Ashland, Ky.	J3	Frnkln. 50	510 hr.	No	895
Bennett Air Serv., P.O. Box 247, Hightstown, N.J.	J3	Frnkln. 50	261 hr.	Just	895
Joseph A. Field, 17 Forman St., Bradford, Pa.	J3	Frnkln. 50	500 hr.	No	875
Virginia Cub Distributors, Box 211, Farmville, Va.	J3	Frnkln. 60	600 hr.	Just	875
Virginia Cub Distributors, Box 211, Farmville, Va.	J3	Cont. 50	400 hr.	Top 300	875
White Fly. Serv., Inc., Caldwell Wright Arpt., Caldwell, N. J.	J3	Lyc. 50	1201 hr.	1/41	875
Lexington Fly. Serv., Inc., Lexington Arpt., Lexington, Ky.	J-3	Lyc. 55	1050 hr.	1000 hr.	875
Southern Arwys. Sales Co., Munic. Arpt., Birmingham, Alabama	J-3®	Frnkln. 50	450 hr.	425 hr.	875
Billie Carpenter, Box 15, Winfield, Kansas	J-3	Frnkln 50	850 hr.	730 hr.	850
Rudy Pekrul, Traverse City Arpt., Traverse City, Mich	J-3-F	Frnkln. 50	1190 hr		850
John P. Hall, West Haven Arpt., West Haven, Conn.	J3	Cont. A50	900 hr.	200 since maj	850
West Coast Arcft., L.A. Mun. Arpt., Inglewood, Calif.	J3	Frnkln. 50	590 hr.	460 hr.	850
Frank Rensma, Box 441, Youngsville, Pa.	J3 Sport	Frnkln.	675 hr.	575 hr.	850
Krantz Aeron. Serv., Port Erie Arpt., Erie, Pa.	J3	Frnkln. 50	950 hr.	no time sincemaj.	850
White Fly. Serv., Inc., Caldwell Wright Arpt., Caldwell, N. J.	J3	Lyc. 50	1300 hr.	7/40	850
White Fly. Serv., Inc., Caldwell Wright Arpt., Caldwell, N. J.	J3	Lyc. 50	1275 hr.	8/40	850
Alabama Air Serv., Auburn Arpt., Auburn, Ala.	J3L	Lyc. 55	900 hr.	9/40	850
Alabama Air Serv., Auburn Arpt., Auburn, Ala.	J3L	Lyc. 53	1100 hr.	9/40	850
Alabama Air Serv., Auburn Arpt., Auburn, Ala.	J3L	Lyc. 55	950 hr.	1/41	850
Midwest Avia. Corp., Norton Fld., Col., O.	J3F	Frnkln. 50	1080 hr.	2/41	850
Akron Airw., Inc., Akron Arpt., Akron, Ohio	J3L	Lyc. 50	765 hr.	600 hr.	850
Akron Airw., Inc., Akron Arpt., Akron, Ohio.	J3L	Lyc. 50	910 hr.	Just	850
Dethloff Fly. Serv., Euclid Ave. Arpt., Willoughby, Ohio	J-3	Frnkln. 50	800 hr.	Just maj.	850
Thomas Metcalf, Toledo Mun. Arpt., Toledo, O.	J-3	Frnkln. 60	810 hr.	620 hr.	825
Red Bank Arpt., Inc., Red Bank, N. J.	J3	Cont. 50	1085 hr.	148 hr.	825
Page Airways, Arpt., Rochester, N. Y.	J3	Lyc. 50	1215 hr.	1086 hr.	800
Avia. Serv., Inc., Box 408, Newport News, Va.	J3L	Lyc. 50	825 hr.	650 hr.	800
Fayette Airways, Inc., Connellsville Arpt., Connellsville, Pa.	J3	Lyc. 50	776 hr.	250 hr.	800
Fayette Airways, Inc., Connellsville Arpt., Connellsville, Pa.	J3	Lyc. 50	632 hr.		800
Matthews & Rappaport, Roosevelt Field, Mineola, N. Y.	J3	Lyc. 55	1500 hr.	Recently	800
Buffalo Aero. Corp., Buffalo Arpt., Buffalo, N. Y.	J3	Frnkln. 50	1200 hr.		800
Hawthorne Fly. Serv., Mun. Arpt., Charleston, S. C.	J3	Frnkln. 50	1011 hr.		$ 800
Hawthorne Fly. Serv., Mun. Arpt., Charleston, S. C.	J3	Frnkln. 50	1150 hr.		800
Thompson Fly. Serv., Inc., Salt Lake City, Utah	J3	Cont. 50	775 hr.	25 hr.	800
Virginia Cub Distributors, Box 211, Farmville, Va.	J3	Frnkln. 50	800 hr.	600 hr.	800
Johnson Flying Serv., Inc., Missoula, Mont.	J-3	Cont. 50	1400 hr.	200 hr.	795
Fayette Arwys., Inc., Uniontown, Penna.	J-3	Lyc. 50	900 hr.	12/40	785
Mayes Field, Huntington, W. Va.	J-3	Cont. Dual Ign.	680 hr.	600 hr.	775
Smith Fly. Serv., Wilkes-Barre Wyoming Valley Arpt., Forty-Fort, Pa.	J-3	Cont. 50	1230 hr.	870 hr.	775
Alabama Air Serv., Auburn Arpt., Auburn, Ala.	J-3	Frnkln. 50	725 hr.	550 hr.	775
Jones Fly. Serv., Sullivant Ave. Airport, Columbus, Ohio	J-3	Frnkln. 50	1500 hr.	No time since fact	775
Southern Arwys., Munic. Arpt., Birmingham, Ala.	J-3	Lyc. 55	1000 hr.	1000 hr.	750
Bob Howe, Gardner Arpt., Gardner, Mass.	J3	Cont. 40	178 hr.	150 hr.	750
Skelly's Fly Serv., Greenville Arpt., Greenville, Pa.	J-3	Lyc. 50	1100 hr.	Maj.	745
Jenkins Air Serv., Mun. Arpt., Rochester, N. Y.	J3 Trainer	Lyc. 50	1080 hr.	890 hr.	725
Avia. Serv., Box 408, Newport News, Va.	J3L	Lyc. 50	1100 hr.	675 hr.	700
Midwest Avia. Corp., Norton Fld., Col., O.	J3F	Frnkln. 50	1068 hr.	2/41	700
Wallace Aircraft Co., Clarcona, Fla.	J2	Cont. 40	700 hr.	May '41	695
Johnny Haralson, Air Trans. & Sales Co., Toney Field, Pine Bluff, Ark.	J-3	Cont. A-44	650 hr.	600 hr.	695
Avia. Market, Los Angeles Metro. Arpt., Van Nuys, Calif.	J-2	Cont. 40	810 hr.	Yes	675
Dethloff Fly. Serv., Euclid Ave. Arpt., Willoughby, Ohio	1936	Cont. 40	175 hr.	No	675
Oakland Arcft., Alameda, Calif.	J-2	Cont. 40	1785 hr.	May '40	665
J. L. Schroeder, Inc., Houston Main St. Arpt., Houston, Texas	J-2 '36 Trainer	Cont. 40	647 hr.	Yes	650
Krantz Aeron. Serv., Port Erie Arpt., Erie, Pa.	J3	Cont. 40	750 hr.	30 hr. since	650
Otha Eddleman, P.O. Box 116, Crane, Texas	J3C	Cont. 40	3.8 hr.	Once	650
McInnis Avia. Serv., Wold Chamberlain Arpt., Minneapolis, Minn.	J-2	Cont. 40	930 hr.	4 hr.	625
Piedmont Avia., Inc., Mun. Arpt., Winston-Salem, N. C.	J-3	Cont. 40	542 hr.	63 hr.	625
Decatur Avia. Co., 776 S. Maffit St., Decatur, Illinois	J3C	Cont. 40	589 hr.	25 hr.	595
Seidner Fly. Serv., S.A.M. Arpt., Youngstown, Ohio	J-2	Cont 40	396 hr.	90 hr.	579
Piedmont Avia., Munic. Arpt., Winston-Salem, N. C.	J-3	Cont. 40	516 hr.	201 hr.	575
Thompson Flying Serv., Inc., Salt Lake City, U.	J3	Cont. 40	1150 hr.	46 hr.	575
Billie Carpenter, Box 15, Winfield, Kansas	J-2	Cont. 40	420 hr.	375 hr.	550
Billie Carpenter, P.O. Box 15, Winfield, Kans.	J2	Cont. 40	375 hr.	50 since	550
Lexington Fly. Serv., Mun. Arpt., Lexington, Ky.	J-2	Cont. A-40-5	825 hr.		550
Blvd. Arpt., Inc., Roosevelt Blvd., Phila., Pa.	J-2	Cont. 40	650 hr.	500 hr.	550
Phillips Fly. Serv., Arpt., Mt. Pleasant, Mich.	J-2	Cont. 40	250 hr.		550
Piedmont Avia., Inc., Munic. Arpt., Winston-Salem, N. C.	J-2	Cont. 40	574 hr.	100 hr.	525
Dawson Air Service, Box 852, Salina, Kansas	1938	Cont. 40	546 hr.	20 hr.	500
PITCAIRN					
Boulevard Arpt., Inc., Roosevelt Blvd., Philadelphia, Pa.	J-6-7	Wright 240	340 hr.	No	1800
PORTERFIELD					
Brayton Fly. Serv., Inc., Lambert-St. Louis Arpt., Robertson, Mo.	A65-8	Cont. 65	229 hr.	No	1550
Al Guthrie, Stillwater Fly. Serv., Box 466, Stillwater, Okla.	LP-65	Lyc. 65	289 hr.	276 hr.	1500
Otha Eddleman, P.O. Box #116, Crane, Tex.	CP-65	Cont. 65	43 hr.	New	1437
Huron Fly. Serv., Inc., Munic. Arpt., Huron, S. D.		Lyc. 65 Dual	700 hr.		1150
Duane L. Huscher, Box 65, Lawton, Okla.	CP. Delux	Cont. 50	302 hr.	None	1100
Al Guthrie, Box 466, Stillwater, Okla.	CP-50	Cont. 50	960 hr.	14 hr.	950
Huron Fly. Serv., Inc., Munic. Arpt., Huron, S. D.		Cont. 50	1023 hr.		850
REARWIN					
Aero Sales Corp., 1008 1st National Building, Birmingham, Ala.	Cloudster '41	Ken-Royce 120	75 hr.		4500
Aircraft Sales of Michigan, Detroit City Arpt., Detroit, Mich.	Cloudster 3 piece	Ken-Royce 120	New	New	4495
C. W. Peterson, Mun. Arpt., Salina, Kansas	Cloudster	Ken-Royce 120 h.p.	300 hr.	Topped 270 hr.	3200
Aircraft Sales of Michigan, Detroit City Arpt., Detroit, Mich.	Skyranger 180	Frnkln. 80	19 hr.		2695
Aero Sales Corp., First National Building, Birmingham, Ala.	Skyranger	Frnkln. 80	New		2545
Aero Sales Corp., 1008 First National Bldg., Birmingham, Ala.	Skyranger	Frnkln. 80	New		2545
C. Evers, 247 Park Ave., N. Y. C.		Warner 90	138 hr.	None	2250

AUTHORIZED AIRCRAFT DEALERS

DEALERS	MODEL AND ENGINE		TIME	OVER-HAULED	PRICE
Paris Fly. Serv., Mun. Arpt., Paris, Texas	Skyranger 175	Cont. 75	125 hr.		$2100
M. H. Wall, P.O. Box 327, Willoughby, O.	Skyranger 175	Cont. 75	35 hr.		1935
Dewey Eldred Fly. Serv., Inc., Willoughby, O.	Skyranger	Cont. 75	40 hr.		1845
Dawson Air Serv., Box 852, Salina, Kansas	9000 L	LeBlond 90	Engine 276 hr.	41 hr.	1200
Robertson Arcft. Corp., Lambert Arpt., Robertson, Mo.	7000	LeBlond 70	367 hr.	'41	1000
Dawson Air Service, Box 852, Salina, Kansas	9000 L	LeBlond 90	276 hr.	'41	1000
Jennings Bros., No. Grafton, Mass.		LeBlond 70	680 hr.	50 hr.	1075
E. W. Wiggins Airways, Inc., Boston Met. Arpt., Norwood, Mass.	8500	LeBlond 85	802 hr.	111 hr.	975
Southern Arwys. of Danville, Box 205, Danville, Va.	1936	LeBlond 85	368 hr.	Never	975
Racine Fly. Serv., Racine Arpt., Racine, Wis.	7000	LeBlond 70	536 hr.	510 hr.	850
Neil McCray, Airport, Jamestown, N. Y.	'36	LeBlond 70	850 hr.	700 hr.	725
ROBIN					
Johnson Fly. Serv., Inc., Missoula, Mont.	4 place	Chall. 185	800 hr.	2 hr.	875
G. L. Williams, Syracuse Arpt., Syracuse, N. Y.		Wright J-65		Starter generator battery recently overhauled	700
RYAN					
Standard Fly. Serv., Inc., Somerset Hills Arpt. Basking Ridge, N. J.	STA	Menasco 125	190 hr.	Major 150 hr.	3450
Schneider Aero. Serv., Chandler Fld., Fresno, Calif.	Photographic B-5	Wright J-6-9 10:15-1 Blower	1625 hr.	120 hr.	1350
SIKORSKY					
Aviation Market, L.A. Met. Arpt., Van Nuys, Calif.	S-39	Wasp 450	540 hr.	40 hr.	6850
E. W. Wiggins Arwys., Inc., Providence, R. I.		Wasp 450	600 hr.	Recently	5500
E. W. Wiggins Airways, Inc., Providence, R. I.	S-39	Wasp 450	600 hr.	200 hr.	5500
STANDARD					
Spooner Air Serv., Claremont Arpt., Claremont, N. H.	D-25	Wright J-5 220	786 hr.	225 hr.	1600
Becker Arcft. Sales, Bettis Arpt., Homestead, Pa.	D-25	J-5-225	500 hr.	150 hr.	1500
A. A. Knowles, Rt. 4, Boise, Ida.	New	Wright J 5,220	417 hr.	3/40	1600
A. A. Knowles, Rt. 4, Boise, Ida.	New	J-5-220	417 hr. Motor	3/40 Motor	900
Bob Wight, Box 487, Biloxi, Miss.	D-25	J-5-220	1275 hr.	670 hr.	850
Blvd. Arpt., Inc., Roosevelt Blvd., Phila., Pa.	D-29-A	Kinner 90	1500 hr.	700 hr.	750
STEARMAN					
A. F. Schachterle, Perkiomen Valley Arpt., Collegeville, Pa.	Hammond	Menasco 50	190 hr.	185 hr.	3500
Brayton Fly. Serv., Inc., Lambert-St. Louis Arpt., Robertson, Mo.	C-3-R	J6 7 Wright	1493 hr.	Just	1600
Stinson Fly. Corp., San Francisco Mun. Arpt., S. San Francisco, Calif.	Hammond	Menasco 150	500 hr.	10/40	1500
Sioux Skyways, Sioux Falls, S. D.	C3R	Wright J 67 250		75 hr. Since Major Approv.	1250
Tacoma Flying Service, Box 157, So. Tacoma, Wash.	C-3-B	Wright J-5 220	1800 hr.	Recently	800
Tacoma Flying Service, Box 157, So. Tacoma, Wash.	C-3-B	Wright J-5 220	1400 hr.	Needs Work	675
Tacoma Flying Service, Box 157, So. Tacoma, Wash.	C3B	Wright J-5	1000 hr.	500 hr.	650
STINSON					
Hyannis Arpt., Corp., Box 592, Hyannis, Mass.	Reliant	Lyc. 245	388 hr.	Major 2/41	6000
Thomas Oakes, 240 Belleville Ave., Bloomfield, N. J.	SR9BD	Lyc. 245	620 hr.	350 hr.	4500
Indiana Air Serv., Inc., Bendix Fld., So. Bend, Indiana	SR-7C	Lyc. 260	1600 hr.	Mar. '41	3500
Neil McCray, Airport, Jamestown, N. Y.	Voyager	Frnkln. 90	165 hr.		3400
Oak Air Serv., Inc., Bates Fld., Mobile, Ala.	Spec. 105	Cont. 80	200 hr.		3250
Piedmont Avia., Inc., Munic. Arpt., Winston-Salem, N. C.	105	Cont. 80 Dual	New	New	3150
Leech Aircraft, Inc., Hangar F, Roosevelt Field, Mineola, N. Y.	1940	Cont. 80	60 hr.		3000
Air Serv., Inc., Bellanca Fld., New Castle, Del.	105	Cont. 80	101 hr.	2 hr.	2950
Cincinnati Arcft. Serv., Lunken Arpt., Cincinnati, Ohio	105	Cont. 80	201 hr.	Never	$2850
P. J. Sones Co., Haines City, Fla.	105	Cont. 80	143 hr.	No	2795
Cincinnati Arcft. Serv., Lunken Arpt., Cincinnati, Ohio	105	Cont. 80	240 hr.	Never	2750
Piedmont Avia., Inc., Mun. Arpt., Winston-Salem, N. C.	105 '40	Cont. 80	246 hr.	34 hr.	2635
Paul E. DePover, Marshall, Minn.	105	Cont. 180	80 hr.		2600
Portland Fly. Serv., Inc., Mun. Arpt., Portland, Maine	105	Cont. 80	260 hr.		2595
Jenkins Air Serv., Inc., Mun. Arpt., Rochester, N. Y.	105	Cont. 80	215 hr.		2550
Moline Fly. Serv., Mun. Arpt., Moline, Illinois	SR-5A	Lyc. 245	850 hr.	760 hr.	2495
Narragansett Avia. Serv., R.I. State Arpt., Hillsgrove, R. I.	105 '40	Cont. 80 Starter	454 hr.	Just Majored	2495
Brayton Fly. Serv., Inc., Lambert-St. Louis Arpt., Robertson, Mo.	105	Cont. 80	260 hr.	Never	2450
John Ruzicks, Circus City Arpt., Peru, Ind.	Reliant	Lyc. 215	460 hr.	60 hr.	2400
Fayette Airways, Inc., Connellsville Arpt., Connellsville, Pa.	105	Cont. 75	146 hr.		2200
Doug Schall, Inc., 33 Clagett Rd., Hyattsville, Md.	105	Cont. 180	200 hr.	Eng.50hr	2450
Colo. Avia. Co., 426 U.S. Nat'l B.B., Denver Colo.	105	Cont. 175	400 hr.	Yes	2150
Upton & Bowen, West Memphis, Ark.	105	Cont. 75	275 hr.	5 hr.	2000
Narragansett Avia. Serv., R.I. State Arpt., Hillsgrove, R. I.	SR 5	Lyc. 225	1350 hr.	10 hr.	1900
Matthews & Rappaport, Roosevelt Field, Mineola, N. Y.	Reliant	Lyc. 215	1800 hr.	Recently	1800
Moberly Fly. Serv., 605 Concannon St., Moberly, Mo.	SR	Lyc. R 680	1220 hr.	40 hr. Back	1400
Becker Aircraft Sales, Bettis Arpt., Homestead, Pa.	SR	Lyc. 225	600 hr.	50 hr.	1350
Akron Airways, Arpt., Akron, Ohio	SR	Lyc.	850 hr.	350 hr.	1350
Akron Airways, Arpt., Akron, Ohio		Lyc. 215	1200 hr.	315 hr.	1300
Doug Schall, Inc., 33 Clagett Rd., Hyattsville, Md.	Stinson '33	Lyc. 215	900 hr.		1300
Springfield Avia. Co., Munic. Arpt., Springfield, Illinois	SM8A	Lyc. 215	750 hr.	360 hr.	1050
Livingston Airways Corp., Chapman Fld., Waterloo, Iowa	SM-8A	Lyc. 215	930 hr.	900 hr.	1000
Maheux Airport, Inc., Stevens Mill Road, Auburn, Maine	SM8A	Lyc. 215	5441 hr.	226 hr.	900
Louis A. Musgrove, Box 814, Morgantown, W. Va.	S	Lyc. 215	1000 hr.	400 hr.	950
DuBois Avia. Assoc., Munic. Arpt., DuBois, Pa.	S	Lyc. 215	1053 hr.	347 hr.	950
Decatur Avia. Co., 776 S. Maffit St., Decatur, Illinois	SM1F	Wright J69 330 h.p.	850 hr.	220 hr.	895
St. Louis Fly. Serv., Inc., Lambert Fld., Robertson, Missouri	S	Lyc. 215	1355 hr.	Recently	875
Flying Dutchman Air. Serv., Sometown Arpt., Phila., Pa.	SM-8A	Lyc. 220	1454 hr.	30 hr.	875
Wappingers Falls, Airport, N. Y.	SM8A	Lyc. 215	800 hr.	675 hr.	850
E. H. Brockenbrough, Munic. Arpt., Charlotte, N. C.	S-M8A	Lyc. 215	850 hr.	820 hr.	800
Becker Arcft. Sales, Bettis Arpt., Homestead, Pa.	SM8A	Lyc. 215	700 hr.		700
Leeward Avia., New Kensington, Pa.	SM-2	Warner 125	550 hr.	Yes	500
TAYLORCRAFT					
Fred C. Romy, Munic. Arpt., Ft. Wayne, Ind.	DeLuxe	Cont. 65	52 hr.		2050
Avia. Mkt., L.A. Metro. Arpt., Van Nuys, Calif.	BL-65	Lyc. 65	38 hr.	New	1875
Hubert & Dillon Air Serv., Box 177-S, Tacoma, Wash.	BL Del.	Lyc. 65 dual	200 hr.		1825
West Coast Arcft., L. A. Munic. Arpt., Inglewood, Calif.	Silvercraft	Lyc. 65	53 hr.	New	1795
Duane L. Huscher, Box 65, Lawton, Okla.	B.C.	Cont. 65	180 hr.		1765
Wichita Falls Air Transp. Co., Box 84, Munic. Arpt., Wichita Falls, Tex.	BL-65	Lyc. 65	New	New	1750
Springfield Avia. Co., Munic. Arpt., Springfield, Ill.	BC-65	Cont. 65	195 hr.	None New	1750
Dufort Sch. of Aeronau., 57 Ft. Covington St., Malone, N. Y.		Cont. 65	390 hr.	May '40	1725
Washington Pk. Arpt., Homewood, Ill.		Cont. 65	150 hr.	None	1650
Palmyra Arpt., 817 Lincoln Ave., Palmyra, N. J.	BL	Lyc. 65 h.p.	138 hr.	Never	1625
Moline Fly. Serv., Munic. Arpt., Moline, Ill.	Deluxe BC	Cont. 65	950 hr.	Maj. now	1600
West Coast Arcft., L. A. Munic. Arpt., Inglewood, Calif.	BC-65	Cont. 65	465 hr.	No	1595
Hubert & Dillon Air Serv., Box 177S, Tacoma, Wash.	BC	Cont. 65	450 hr.	Motor topped	1525
Roch. Aeron. Corp., Roch. Arpt., Roch., N. Y.	BL-65	Lyc. 65	80 hr.		1525
Bob Howe, Gardner Arpt., Gardner, Mass.	BC '40	Cont. 65	193 hr.	New	1500
Narragansett Avia. Serv., R.I. State Arpt., Hillsgrove, R. I.	BL 40	Dual Ign. Lyc. 65	254 hr.	Will be	1495
McInnis Avia. Serv., Wold Chamberlain Arpt., Minneapolis, Minn.	BL-65	Lyc. 65	68 hr.	New	1475
Fred C. Romy, Munic. Arpt., Ft. Wayne, Ind.	DeLuxe	Cont. 65	830 hr.	1/5/41	1465
Moline Fly. Serv., Munic. Arpt., Moline, Ill.	BL	Lyc. 65	250 hr.	None	1450
Upton & Bowen, West Memphis, Ark.		Lyc. 65	560 hr.	5 hr.	1450

FLYING and POPULAR AVIATION USED PLANE LISTING OF AUTHORIZED AIRCRAFT DEALERS

DEALERS	MODEL AND ENGINE		TIME	OVER-HAULED	PRICE
Ranger Fly. Serv., Ranger, Texas	BL-65	Lyc. 65	140 hr.	140 hr.	$1450
Rochester Aeronautical Corp., Rochester Arpt., Rochester, N. Y.	BL-65	Lyc. 65	470 hr.		1450
Inter-City Fly. Serv., Munic. Arpt., Ft. Wayne, Ind.	BC DeLuxe	Cont. 65	800 hr.	757 hr.	1445
Tuscarawas County Avia. Inc., Munic. Arpt., New Philadelphia, Ohio	BL	Lyc. 65	448 hr.	Never	1400
Moline Fly. Serv., Munic. Arpt., Moline, Ill.	DeLuxe BL	Lyc. 65	675 hr.	None	1400
Palmyra Arpt., 817 Lincoln Ave., Palmyra, N. J.	BL	Lyc. 65	318 hr.	Never	1400
Ranger Fly. Serv., Munic. Arpt., Ranger, Texas	BL-65	Lyc. 65 dual	170 hr.	170 hr.	1395
Washington Pk. Arpt., Inc., Homewood, Ill.		Lyc. 50	83 hr.	None	1390
Washington Pk. Arpt., Inc., Homewood, Ill.		Lyc. 50	104 hr.	None	1375
Dawson Air Serv., Box 852, Salina, Kans.	DeLuxe BL	Lyc. 65	840 hr.	Just	1350
Dufort Sch. Aerona., 57 Ft. Covington St., Malone, N. Y.	BT	Lyc. 55	225 hr.	New Oct. '40	1350
Ranger Fly. Serv., Ranger, Texas	BL-55	Lyc. 55	180 hr.	180 hr.	1350
Inter-City Fly., Munic. Arpt., Ft. Wayne, Ind.	BL '40	Lyc. 50	326 hr.		1325
Tuscarawas Co. Avia., Inc., Munic. Arpt., New Philadelphia, Ohio	BL	Lyc. 65	639 hr.	Never	1300
Greenville Sch. Avia., Treaty City Arpt., Greenville, Ohio	BL	Lyc. 65	265 hr.	None	1300
Hopewell Fly. Serv., Hopewell Arpt., Hopewell, Va.	BL-65	Lyc. 65	375 hr.	9/40	1300
Harold Klaehn, Munic. Arpt., Ft. Wayne, Ind.	DeLuxe	Lyc. 50	340 hr.	No	1295
Washington Pk. Arpt., Inc., Homewood, Ill.		Lyc. 55	235 hr.	None	1295
Greenville Sch. Avia., Treaty City Arpt., Greenville, Ohio	BL	Lyc. 55	185 hr.	None	1250
Earl J. Howard, P.O. Box 565, Ames, Iowa	BLT	Lyc. 65	510 hr.	None	1200
Marlboro Arpt., Inc., Farm Road, Marlboro, Mass.	BL-65	Lyc. 65	372 hr.	None	1200
Marlboro Arpt., Inc., Farm Road, Marlboro, Mass.	BLT-55	Lyc. 55	472 hr.	None	1200
Rochester Aeron. Corp., Rochester Arpt., Rochester, N. Y.	BL-55	Lyc. 55	500 hr.	None	1200
Boyd Mote, Denman Ave., Coshocton, Ohio	BL-50	Lyc. 50	105 hr.	New 1940	1195
Dufort Sch. Aero., 57 Ft. Covington St., Malone, N. Y.	BT	Lyc. 55 h.p.	395 hr.	New May '40	1175
Dawson Air Serv., Box 852, Salina, Kans.	DeLuxe BL	Lyc. 55	720 hr.	60 hr.	1150
Dawson Air Serv., Box 852, Salina, Kansas	DeLuxe	Lyc. 55	790 hr.	90 hr.	1100
Palmyra Arpt., 817 Lincoln Ave., Palmyra, N. J.	BLT	Lyc. 50 h.p.	373 hr.	83 hr. Since Maj.	1100
Dewey Eldred Fly. Serv., Lost Nation Arpt., Willoughby, Ohio	BL-65	Lyc. 65	831 hr.	Ship 11/40	1100
Phillips Flying Service, Arpt., Mt. Pleasant, Mich.	BL-50	Lyc. 50	800 hr.	650 hr.	1100
Duane L. Huscher, Box 65, Lawton, Okla.	BF	Frnkln. 50	1302 hr.	197 hr.	1050
Decatur Avia. Co., 776 S. Maffit St., Decatur, Ill.	BL	Lyc. 50	570 hr.	No	1050
Ryan Air Serv., Decorah, Iowa	Late '39	Lyc. 50	770 hr.	350 hr. Since	1050
Wichita Falls Air Transp. Co., Box 84, Munic. Arpt., Wichita Falls, Texas	BLT-55	Lyc. 55	400 hr.	50 hr.	1050
Phillips Fly. Serv., Arpt., Mt. Pleasant, Mich	BL-50	Lyc. 50	1100 hr.	900 hr.	1050
Merrill Hale, Hillsgrove, R. I.		Frnkln. 50	268 hr.	35 hr.	1050
Indiana Air Serv., Bendix Fld., South Bend, Ind.	BL	Lyc. 55	1038 hr.		1000
Louis A. Musgrove, Box 814, Morgantown, W. Va.	BL	Lyc. 50	725 hr.	150 hr.	1000
Spartan School of Aeron., Box 2551, Tulsa, Okla.	BL-50	Lyc. 50	1400 hr.	160 hr.	1000
Rochester Aeron. Corp., Rochester Arpt., Rochester, N. Y.	BL-65	Lyc. 65	1102 hr.	140 hr.	1000
Narragansett Avia. Serv., R. I. State Arpt., Hillsgrove, R. I.	BF	Frnkln. 50	351 hr.	130 hr. Since	995
Dewey Eldred Fly. Serv., Lost Nation Arpt., Willoughby, Ohio	BLT-50	Lyc. 50	875 hr.	Recently	975
Schneider Aero. Serv., Chandler Fld., Fresno, Calif.	BC	Cont. 50	1216 hr.	106 hr.	950
John P. Hall, West Haven Arpt., West Haven, Conn.	BL	Lyc. 50	440 hr.	New Motor	950
Indiana Air Serv., Bendix Fld., South Bend, Ind.	BL	Lyc. 50	970 hr.		900
Hobley-Maynard Air Serv., Inc., New Orleans Arpt., New Orleans, La.	BL-50	Lyc. 50	1500 hr.	Recently	900
Foster A. Lane, Lane Avia. Corp., Cleveland Arpt., Cleveland, Ohio		Lyc. 50	950 hr.	50 hr.	875
Moberly Fly. Serv., 605 Concannon St., Moberly, Mo.	'39	Frnkln. 50	720 hr.	Topped 60 hr. ago	875
Piedmont Avia., Munic. Arpt., Winston-Salem, N. C.	39	Frnkln. 50	563 hr.	164 hr.	825
Dufort Sch. of Aero., 75 Ft. Covington St., Malone, N. Y.		Frnkln. 50	770 hr.	Just Maj.	825
Jennings Bros., No. Grafton, Mass.		Cont. 40	660 hr.	100 hr.	800
Canton Avia. Co., Martin Fld., Canton, O.	BLT	Lyc. 50	780 hr.	Engine Maj.	795
Canton Avia. Co., Martin Fld., Canton, O.	BLT	Lyc. 50	815 hr.	Eng. Maj.	795

DEALERS	MODEL AND ENGINE		TIME	OVER-HAULED	PRICE
Kenneth Benesh, Monticello, Ia.	A	Cont. 40	180 hr.	None	$ 745
Duane L. Huscher, Box 65, Lawton, Okla.	A	Cont. A40-4	600 hr.	75 hr.	725
Rome Boekenhoff, Jr., 2038 Spring St., Quincy, Ill.	A	Cont. 40	576 hr.	2/41	700
Carnahan Fly. Serv., Bloomington, Ill.		Cont. 40	507 hr.	Since 100 hr.	700
Merrill Hale, Hillsgrove, R. I.		Cont. 40	1081 hr.	100 hr.	695
Virginia Cub Distributors, Box 211, Farmville, Va.		Cont. 40	500 hr.	Just	675
Springfield Avia. Co., Munic. Arpt., Sprgfld., Ill.		Cont.A-40-4	375 hr.	None	650
J. L. Wells, 106 W. Main, Avon Park, Fla.		Cont. 40	690 hr.	100 hr.	650
Inter-City Fly. Serv., Ft. Wayne, Ind.	'38	Cont. 40	600 hr.		600
E. H. Brockenbrough, Munic. Arpt., Charlotte, N. C.	A	Cont. 40	550 hr.	520 hr.	600
Southern Airways, Munic. Arpt., Birmingham, Ala.	A	Cont. 40	375 hr.	350 hr.	550
TRAVELAIR					
Falcon Arcft. Corp., L.A. Munic. Arpt., Inglewood, Calif.	Osprey	Wright 250	814 hr.	Major 80 hr.	2500
Indiana Air Serv., Inc., Bendix Fld., So. Bend, Ind.	4000	Wright J-5, 220	940 hr.	7/40	1200
McInnis Avia. Serv., Wold Chamberlain Arpt., Minneapolis, Minn.	4000	Wright J-5, 220	1590 hr.	110 hr.	1175
Regan Flying Serv., Box 946, Shawnee, Okla.	E-4000	Wright 175	332 hr.	325 hr.	1150
Kenneth Benesh, Monticello, Ia.	4000	Wright J-5, 225	1200 hr.	30 hr.	1100
Cedar Rapids Arwys., Inc., Cedar Rapids, Ia.	4000	Wright J 6 5	12 hr.	since	1050
C. W. Peterson, Munic. Arpt., Salina, Kans.	C-4000	Chall. 185	600 hr.	Topped 12 hr.	1000
Leeward Avia., New Kensington, Pa.		Chall. 185	700 hr.	Yes	745
Decatur Avia. Co., 776 S. Maffit St., Decatur Ill.	2000	Tank 115	855 hr.	150 hr.	675
Walling Aviation Co., Watertown, N. Y.	2000	OX 90	375 hr.		500
WACO					
J. Wayde Stewart, 1319 Avery St., Parkersburg, W. Va.	N	Jacobs 330	100 hr.		5500
Robertson Aircraft Corp., Lambert Munic. Arpt., Robertson, Mo.	AGC-8	Jacobs 330	750 hr.	'41	5000
Livingston Airways Corp., Chapman Fld., Waterloo, Ia.	S '37	Jacobs 225	185 hr.		4200
Virginia Cub Distributrs, Box 211 Farmville, Va.	Standard	Jacobs 225	325 hr.	150 hr. since	3500
Aircraft Sales Corp., 1240 Lawrence Ave., Chicago, Ill.	YKS-7	Jacobs 225	205 hr.		3500
Doug Schall, Inc., 33 Clagett Rd., Hyattsville, Md.	Custom Cab '36	Wright 285	800 hr.	Eng. 50 hr.	3400
Air Serv., Inc., Muncie. Arpt., Denver, Colo.	Cust. Cabin	Jacobs 225	990 hr.	2/41	3400
Northern Okla. Fly. Serv., P.O. Box 556, Blackwell, Okla.	YKS 6	Jacobs 225	408 hr.	Ship 16 hr.	3250
Aviation Market, L.A. Metro. Arpt., Van Nuys, Calif.	S-7	Jacobs 225	310 hr.	No	3250
Buffalo Aeronautical Corp., Buffalo, N. Y.	YKS	Jacobs 225	1745 hr.	50 hr.	3000
New Mexico Fly. Serv., Box 67, Clovis, N. M.	YKS	Jacobs 225	510 hr.	90 back	2750
New Mexico Fly. Serv., Box 67, Clovis, N. M.	YKS-7	Jacobs 225	511 hr.	90 hr.	2750
E. W. Wiggins Airways, Inc., Boston Met. Arpt., Norwood, Mass.	C	Wright 285	413 hr.	5 hr.	2500
E. W. Wiggins Arwys., Inc., Providence, R. I.	C	Wright 285	350 hr.	Recently	2500
Avia. Serv. Co., Inc., P.O. Box 32, Hartford, Conn.	YOC	Jacobs 225	720 hr.	220 hr.	2250
Inter-City Avia., Inc., Boston Munic. Arpt., E. Boston, Mass.	Cabin	Jacobs 225	845 hr.	213 hr.	2175
John P. Hall, W. Haven Arpt., West Haven, Conn.	YMF	Jacobs 225	710 hr.	60 hr.	2100
J. L. Wells, 106 W. Main, Avon Park, Fla.	YKC	Jacobs 225	650 hr.	200 hr.	2000
Southern Arwys. of Danville, Box 205, Danville, Va.	YKC	Jacobs 225	917 hr.	550 hr.	1850
Greenville School of Avia., Treaty City Arpt., Greenville, Ohio	Cabin	Con. 210	850 hr.	2/41	1750
Hawthorne Flyng Serv., Munic. Arpt., Charleston, S. C.	Cabin '32	Cont. 165	575 hr.	500 hr.	1595
Arthur J. Davis, E. Lansing, Mich.	CTO	Wright-7	780 hr.	Yes	1500
Arthur J. Davis, E. Lansing, Mich.	F	Warner 125	124 hr.	Factory	1400
Arthur J. Davis, East Lansing, Mich.	F	Warner 125	480 hr.	Relicens. May 14	1350
Hawthorne Fly. Serv., Munic. Arpt., Charleston, S. C.	Cabin '32	Cont. 165	Approx. 600 hr.	@500 hr.	1295
Buffalo Aero. Corp., Buffalo Arpt., Buffalo, N. Y.	F-2	Cont. 165	875 hr.	100 hr.	1250
Henry B. Chapman, N.O. Arpt., New Orleans, La.	RNF	Warner 125	720 hr.	6 hr.	1100
Red Bank Airport, Inc., Red Bank, N. J.	ENF	Martin 120	575 hr.	35 hr.	1089
Southern Air Serv., Memphis, Tenn.		Warner 125	1000 hr.	Recently	1050
Avia. Serv. Co., Inc. P.O. Box 32, Hartford, Conn.	QDC	Cont. 165	1063 hr.	203 hr.	1000
Arthur J. Davis, E. Lansing, Mich.	CTO	Wright J6-9	1200 hr.		900
J. A. Atherton, Box 608, Rochester, Minn.	RNF	Warner 125	1006 hr.	825 hr.	850

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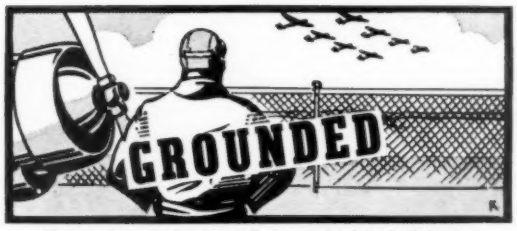

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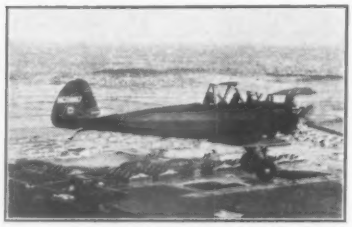

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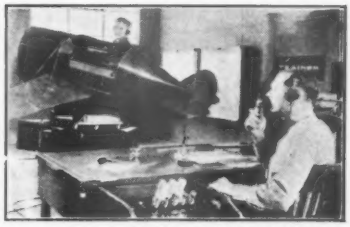

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